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JAMES SWAN, H. H. BROWN } Editors
L. S. BLODGETT, Associate Editor W. Z. GARDNER, News Editor

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The Marine Congress

FOR the first time since the movement to encourage and promote the growth of the American merchant marine was initiated, a body of men, representing the general business interests of the country, has met together for the consideration of this great national problem, and is effecting a permanent organization to carry on the work and to coordinate and concentrate the various forces tending towards its successful prosecution.

The deliberations of the Marine Congress, composed as it was of representatives of a hundred different and widely varying commercial bodies and organizations, represent the result of matured thought and careful analysis of ways and means on the part, not only of those directly interested in shipping, but of merchants, manufacturers, farmers—in short of men representing the commercial interests of the entire United States.

That the country is awake to the necessity of a merchant fleet and to the very direct bearing which the possession of this fleet has upon the future prosperity of its citizens is becoming daily more apparent. There is no question but that the problem of placing American ships on the high seas and keeping them there will largely occupy the attention of the approaching session of Congress, and the submission to that body of a definite policy to attain this end will go far toward making effective action possible.

So far as can be judged by the daily press, a majority of the people have come to a realization of the fact that an adequate merchant marine is necessary, if the country is to retain any control of its export business, possess an efficient navy and in every other respect to hold its position as a first class power among the nations of the world. It is equally apparent that a majority of the people are of the opinion that this merchant marine should be privately owned and operated.

It is important that senators and representatives should come to a realization of these facts. It is also important that they should understand clearly that the body submitting these facts for their renewed consideration is a national body and that steps are being taken to make it a permanent one.

The Shipbuilding Outlook

THERE is no disguising the fact that the "Naval Holiday," beneficial as its results may be to the world in general (and we are by no means certain that it is an "unmixed blessing," even in this particular) has given a staggering blow to the shipbuilding industry. The large shipyards have to a great extent attained their present size and perfection of equipment as a result of the demand for battleships, and for many years it has been the foundation of large naval work which has made the building of others and less important vessels economically possible. Now that this foundation is to be removed, what are the possibilities of continued operation for these large and costly "private navy yards"?

A large shipyard includes in its operation many mechanical trades or lines of work, and the individual shops of which it is comprised can each produce articles of general value. Such a plant, however, if properly laid out for economical ship production, does not lend itself readily to manufacturing processes, and to fit it for succesful competition in such fields considerable modification is necessary. It is idle to suppose that an ordinary shipyard structural shop can, in the long run, successfully compete with a modern bridge shop, nor that a shipyard machine shop and boiler shop can economically produce locomotives. A shipbuilding company can, of course, alter its shops to produce successfully almost any structure or machine, but it then ceases to be a shipyard, although it still has the enormous investment in shipways, cranes and heavy machinery hanging on its neck and serving only to keep up maintenance and overhead expenses.

Mr. Powell, in his speech at the annual dinner of the Society of Naval Architects and Marine Engineers last month, stated this condition clearly and frankly, and his suggestions as to how it may best be met appear to us as sensible and worthy of the careful consideration of everyone having the welfare of the shipbuilding industry at heart.

Discouraging as the outlook appears in the aggregate, it is by no means, as some persimists would have us believe, as

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bad as possible. Shipbuilding in this country is a very long way from being dead. Many vessels are under construction, and it is altogether probable that a larger number will be required in the future, but the volume of work, as represented by the amount of money expended, will probably not equal that of the era of battleship construction for many years to come.

Mr. Powell suggests that, from every point of view, it is better to meet the future demand for ships with a relatively small number of yards, working efficiently and at something like normal capacity, than with a large number, each working at a fraction of the output necessary to carry its overhead and all facing eventual and inevitable disaster.

Hard as this suggestion may be in its accomplishment, the logic of it is unquestionable. So far as can now be seen, the eventual prosperity of American shipyards can be assured only by a process of elimination and combination whereby such a number of efficient yards will be kept in operation as bears a reasonable relation to the total amount of work to be turned out.

Shipping Board Economies

THE record of the various economies already effected or being put in practice by the operating department of the Emergency Fleet Corporation reflects credit upon those responsible for the operation and maintenance of the Shipping Board's fleet.

With the detail methods of operating the government vessels we are not familiar, but the steps taken in this connection to prevent waste and eliminate unnecessary expense appear entirely reasonable and, judging from the figures given, are producing satisfactory results.

In one particular, however, we are inclined to take issue as to the entire wisdom of the policy being followed. This is in relation to the care of laid-up vessels. Fundamentally, the greatest saving possible would result from the elimination of all vessels (and there is a very considerable number of them) which have no commercial value, thus, at one stroke, cutting out a large part of the present expense of upkeep, as well as removing a fleet of ships, which, while it will not in all human probability ever be commercially employed, is, nevertheless, a menace to the satisfactory settlement of the country's shipping problem.

We realize quite well that the sale or other disposal of laid-up vessels is a matter quite outside the jurisdiction of the operating department, and mention it only to indicate our belief that a major and not a minor operation is needed to satisfactorily solve the laid-up ship problem.

Turning then to the methods pursued in caring for these vessels, we believe that everyone will agree as to the wisdom of fleet concentration with the consequent reduction of caretaking personnel, as well as the elimination of wharfage charges. The physical care of the ships, however, may easily be neglected to the point where serious deterioration sets in, and we fear that this point has been reached, or will be shortly, by practically all of the laid-up ships. Although the total of the laid-up fleet personnel appears at first glance a large one when the number of ships to be cared for is taken into consideration the number of men available per ship becomes entirely inadequate to properly handle the situation. By eliminating "dead" tonnage and concentrating upon potentially valuable vessels, effective upkeep might be maintained without a greater total expense than at present. We believe, however, that the more valuable ships should be cleaned, painted and otherwise thoroughly preserved at the earliest practicable date. With this properly accomplished, a laid-up crew of very moderate size can render all the attention necessary for a long time to come. On the other hand, the ships are in a condition where a year or two more at the present rate of depreciation will render them useless or at least in a condition requiring extensive repairs to fit them for service.

Weakness of the Shipping Board

IN an address on the Shipping Board at the Marine Congress dinner recently given in New York, Commissioner Haney made, in substance, the following rather interesting and unique statement: "When I was asked to become a member of the Board, I hesitated considerably before accepting as I felt that I had but little knowledge of shipping affairs. However, my friends advised me to accept as I 'certainly knew as much about it as any of those other fellows.' "

We have no doubt as to the ability and personal integrity of Mr. Haney, nor indeed of that of the other members of the Board; but does not the above statement go far to explain the apparent lack of cohesion shown by the actions of the Shipping Board, its failure to work in sympathy with private owners and operators and, finally, the enormous expense involved in its activities?

It seems to us that it is about time for this very important body to be composed of men whose lives have been devoted to the work which the Board was created to oversee and foster, and that the fact that a man is considered "to know as much as those other fellows" is not a sufficient recommendation for membership.

Even were the Board made up entirely of men peculiarly fitted for the work, the possibility of effective functioning as an executive body is remote. In an advisory capacity, a committee of seven may be desirable, but for prompt and efficient executive action a much smaller body is essential; and one good man, if he could be found, would produce more and better results than any committee could possibly accomplish.

The present attitude of the administration apparently makes inevitable the continuation of the Board's activities for some time to come. Assuming this to be the fact, cannot steps be taken by the forthcoming Congress to reduce the Board to a workable size and restrict its members to those having expert knowledge of the questions which they are called upon to decide?

Work of great value has been accomplished in certain of the departments comprised in the Board's activities. Its members should have sufficiently expert knowledge to appreciate the importance of such constructive results as have been attained and to so direct its line of action in the future that it may be a help and not a hindrance to the development of the merchant marine.

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Secretary Hoover Declares Our Merchant Marine Indispensable for Protecting Our Foreign Trade

Address of the Secretary of Commerce at the Marine Congress Banquet Shows How Double Taxation of American Merchants Abroad Is Handicapping Growth of Our Overseas Shipping

AS the principal speaker at the Marine Congress banquet held at the Waldorf-Astoria Hotel, New York, on Thursday evening, November 8, under the auspices of the American Marine Association, Herbert Hoover, Secretary of Commerce, reiterated the facts so well known to all ship-minded American citizens that we must have our own ships for the protection of our foreign trade, for the expansion of our exports and for our national defense but he also pointed out one disastrous handicap to the growth of our merchant marine which is generally overlooked but which is capable of remedy and that is the double taxation of our merchants abroad. Secretary Hoover's address was as follows:

It is simply a truism to say that we must have an American merchant overseas marine. Entirely apart from the fine sentiment and national pride of a great trading nation in keeping its flag upon the seas, we must have our own ships for the protection of our foreign trade; we must have ships if we would expand our exports on sound lines and we must have them as an auxiliary to our national defense.

Our Standards of Living Depend on International Trade

It seems worth repeating at times that our international trade is one of the very foundations of our standards of living; that our whole fabric of living and comfort are dependent upon the import of commodities which we do not and can not ourselves produce—tin, rubber, coffee, sugar and a score of others; further, in the main the amount of these commodities we can import will depend upon the volume we export. Moreover we need a constant expansion of our export markets to give stability to our internal production by a wider range of customers.

If we are to have secure export markets we must have some sound proportion of American controlled shipping to assure us against combinations in rates which would prejudice our goods in competitive markets. Nor have our merchants been without the experience of finding that the transport of our goods in foreign bottoms has been taken advantage of by our competitors to learn the details of our trade connections.

The facility of the world in creating combinations in restraint of trade has been growing by leaps and bounds since the war and while we, as a nation, endeavor to curb these activities within our borders, there has naturally been no curbing of these activities abroad when they affect American interests. Today there are many commodities upon which we are dependent by import from foreign lands in which there are combinations in control of price in those foreign lands. Combinations in control of sea rates are the commonest thing in the world shipping fabric. Many of our raw material exports, such as wheat, are sold in the world market in competition with those of other countries and the price level in these cases is the result of competitive streams that flow into these world markets. In wheat the farmer's return is fundamentally the price which he receives at Liverpool less the cost of transportation and handling. Therefore, any increase in shipping rates is in fact a deduction from the price to the farmer. It is just as important to him to be guaranteed reasonable rates of sea transport as of land freight.

The real security is an American-owned merchant marine. In the long view the expansion of our foreign trade must and will take place in the export of larger proportions of manufactured goods. The primary requisite for such expansion is the assurance of regularity in transportation. Not only do we need regularity of sailings week by week, in order that the manufacturer may be assured in his problems of delivery, but our merchants and manufacturers require to know that when they have established their goods in foreign lands then regular transportation will be assured to them over years to come. They can not be dependent upon hazards of foreign shipowners, allied as these owners are with foreign merchants and competitors.

Adequate Transportation Under Our Flag a Necessity

We must have especially regular and positive transportation under our flag on those great trade routes where our commerce can and will expand. Nor can America be dependent for her movement of overseas goods upon the make and break of peace and war in different parts of the world. We have had one gigantic national experience with this already. We must have ships under our own flag, if we are to have security in our vital supplies and exports when other nations go to war with each other. As an auxiliary of our national defense we must have preparedness in transport for soldiers and supplies; we must have a training ground for our sailors, or our Navy itself would be helplessly confined to our own coasts.

In a broad sense the American people are endeavoring to establish a merchant marine that will adequately protect and promote our commerce. The ideal is regular, ferry-like service of boats of the cargo liner type with some passenger capacity traversing the great trade routes of the world and carrying at least 50 percent of our foreign trade. Today, outside of oil, we are carrying less than 20 percent. Some day we will attain such a merchant marine. Our national necessities, the capacity of our people for organization, for mechanical development and enterprise will some day bring it about. In the meantime we have much divided opinion in public mind, in the shipping world and in Congress, as to method. And our shipping world is suffering from great handicaps.

American Merchants Needed Abroad

It is not my purpose to review all these handicaps that are so familiar to you but rather to present to you one single phase that has not been so generally considered that is capable of remedy. That is the relationship that American merchants abroad must bear to the success of an American merchant marine. We will never have a real American merchant marine until we have a much larger complement of merchants of our own nationality conducting our commerce in foreign ports. Our raw materials are largely sold at our shores to foreign merchants. They dictate the shipping. Again most of our purchases of raw materials are for delivery at our shores. The foreign merchant again controls

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the shipping. If we except oil, most of our manufactured goods for export are dealt with by foreign merchants. How real all this is, is shown by the fact that except oil only about 12 percent of our imports and exports were managed by American merchants abroad.

The situation is just as insecure for our exports as for our shipping. If we would make sure of the continuous flow of goods, we must have the American on the ground distributing to the foreign retailer, securing business by his services as well as his price. Many an American merchant has seen his established trade disappear because he depended upon a foreign merchant not to show patriotism to his own country. This situation has been contributed to by the tendency of some of our manufacturers to regard export as a happy hunting ground in times of domestic depression, to be abandoned in times of domestic demand. We cannot have a merchant marine without an army of American merchants in foreign ports. This is the foundation of our British competitors.

No stable consumption of goods can be built upon such a fabric. And other things being equal, the merchant ships his goods under his own flag, even giving a preference to that flag. Our competitors certainly do so. The lack of growth in our merchant personnel abroad is, I believe, to a large degree the fault of our Government for reasons I will detail later.

Despite our expanding export and import trade, the number of our merchants abroad has decreased in late years and yet if we would have a merchant marine they must be increased. The taxation policies of our Government have been to a considerable degree responsible for this situation.

Our Merchants Abroad Forced to Pay Double Taxes

We are asking our people to expatriate themselves in order to sell American goods and manage American ships. Our own Government demands in income and corporation taxes up to 58 percent of the profits of our merchants resident abroad. They also pay taxes to the government where they reside. Thus we demand that they pay double taxes. We are the only nation who does such a thing. With tax burdens even greater than ours, our competitors in the world today have freed their merchants resident abroad from this double taxation. For instance, an American merchant firm in London today must pay British taxes amounting directly or indirectly up to 50 percent of his income. The American Government comes along and claims the same sum or even more. In countries not participants in the war, such as the Argentine, the British merchant pays no taxes to his home government, whereas our merchant must pay his taxes in full.

It is, therefore, felt by many as more economic for Americans to stay at home and sell their goods in the Argentine through a German or a British merchant. Scores of our merchant firms, totally discouraged, have thrown up the sponge.

American Engineers Find Foreign Missions Unprofitable

Before the war, there were at least 1,000 American engineers employed at substantial salaries in the territories of our former allies. These men went abroad to install American methods, American machinery and equipment in the production of raw materials, and in transportation. These salaried workers now find themselves subject to two gigantic income taxes and thus their foreign mission is unprofitable. I doubt whether there are 100 of them left in foreign territories today. A vast amount of American machinery and equipment that followed in their wake has dried up.

There is one phase of this matter of vital importance to our farmers. Over 80 percent of our agricultural exports go to Europe. Before the war European merchants bought stocks of wheat and grain during our fall marketing season and thus assisted in financing the crop. They carried stocks in European warehouses thus relieving our congestion. Today, shortage of finance and credit leads them to buy from day to day and thrusts the burden of carrying the world's seasonal reserves either upon our own farmers or upon our merchants. If our merchant firms were established in Europe, it would be possible for them to give delivery at that end and to establish short credits to their customers—all of which would relieve our farmers. But American merchants are not likely to establish in Europe and to pay two income taxes which might absorb up to 75 percent of their income.

Another case of pertinent order is that on the China coast. Inasmuch as China has no dependable corporation law much Chinese capital is invested in foreign corporations under the management of, or in partnership with, Europeans. As foreign governments exact no home taxation from such corporations or their stockholders the Chinese naturally prefer them. We attempted to remedy this by Congressional authority to establish special American corporations under Federal authority but the restrictions are such that the act has failed its purpose. Three large American managed businesses have gone over to control of our competitors at a real loss to our foreign trade and the great discouragement of our merchants. Similar questions are arising in the Philippines.

Dispersion of American Merchants Essential to Development of Our Shipping

I wish to repeat that, if we are to secure the establishment of a merchant marine, we must secure dispersion of the American merchant and our Government today is one of the most destructive influences in the whole matter. I do not wish to argue the theory that Americans who are engaged abroad in reproductive work should not bear their share of the national burden. I would only point out that other nations have found it is uneconomic to impose this burden upon them, and that we are left in a prejudiced position. Nor am I pleading the cause of the American expatriot, who prefers foreign civilization as a luxury, who is bringing no returns to his country by way of his savings or by way of his expansion of American trade.

These two groups are quite distinct. They can be distinguished in tax measures so as to apply the relief only to incomes earned abroad. One is tied passionately to his country's interests and the expansion of its welfare; America to him is the home he serves in managing her trade. He will yet return with his savings to add to the national wealth, whereas the other is but a pensioner on our national resources. And yet as a nation we penalize the one who brings us service and credit.

Notice to Subscribers

THE annual index of MARINE ENGINEERING AND SHIPPING AGE for the year 1923 will be published separately from the magazine at the end of the year. As the complete index will be useful only to those of our subscribers who have kept a complete file of the magazine for the year, only a sufficient number of copies will be printed to meet the requirements of those who notify us before the end of the year of their desire for a copy.

A copy of the annual index will be mailed without cost to each subscriber whose request for it is received at our New York office on or before January 1.

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To Develop Foreign Trade—

Ship and Sail in American Vessels. Money Spent for This Service Should Be Developing Our Own Maritime Resources, Not Those of Our Competitors

By "Old Scotch"

ONCE upon a time a prosperous farmer in the great West, who was supposed by his neighbors to be a good business man, ordered 50 tons of fertilizer from a distant point for the annual requirements of his vast acreage and in due course it was delivered at the railroad station, located five miles from his home. It was early springtime and there was nothing much to do except to attend to the daily chores. His four horses were largely employed in eating their daily rations of hay and corn, the two hired men attended to the chores night and morning and loafed most of the day. The two farm wagons had not been used much during the latter part of the winter and needed some small repairs and a general greasing up to put them in good working condition. Much to the surprise of the loiterers around the railroad station, this supposedly good business farmer appeared one day and made arrangements with a Scandinavian teamster to haul the fertilizer out to the farm at a rate of three dollars a ton, thereby decreasing his account at the village bank to the tune of one hundred and fifty dollars. In a group of the wise men who always gather around the stove at the village store this conversation took place:

"I see that old man Perkins (for that was his name) has hired Olsen to cart that fertilizer out to his farm and by Heck he paid him three dollars a ton for doing it. His own horses are eating their heads off and the two hired men will soon want patches on their pants, and they won't be sewed on their knees either."

"Yes," said the second wise man, "he allowed to me that it wouldn't pay him to haul it himself as his two wagons needed about fifteen dollars' worth of repairs, and anyway it was getting too near planting time to bother with doing his own hauling."

"Well," said the storekeeper, the usual arbitrator in all such discussions, "Perkins better watch out as I've seen the sheriff put a red flag on better farms than his where they've been run by just such bum management as that."

Suppose this village store jury, composed, as the thousands of them are, of good, hard working, common-sense taxpayers who go to make up a great part of the American public, should cast their critical eyes and sound logic on the way Uncle Sam treats his merchant marine, don't you suppose they would find many parallels to Farmer Perkins' unbusinesslike procedure of hiring a man to cart the fertilizer from the station while his own facilities are growing cobwebs?

Cuban Sugar Offers Opportunity to American Ships

Suppose, for example, it dawns upon them that the Cuban sugar crop, used almost entirely by the American people who have the largest sweet tooth of any peoples in the world, is brought to our Atlantic ports every year by alien ships, while several of our large rivers, which empty into the Atlantic Ocean, are harboring vast fleets of idle ships owned by the government. And among these fleets swinging idly at their anchors are ships whose size especially adapts them for traffic to Cuban ports where the sugar shipments are made. As the sugar season is in the winter months, hundreds of seafaring officers and men are idle and available to man these ships; repair yards and drydocks are only partly employed and willing and anxious to put these ships in condition for this trade. Does not this condition almost parallel the action of Farmer Perkins?

Before me as I write this is an item in one of our commercial dailies which reads as follows:

American Coal Exported in Foreign Ships

"An American firm has just closed a contract to supply French Government Railways with 100,000 tons of American coal at $7.25 c.i.f. It was learned yesterday that steamers of the Lloyd Royal Belge fleet will move this coal in equal monthly shipments at $2.25 per ton during 1924."

Can you imagine that any shipper in Great Britain, receiving such an order as this, would for a moment consider delivering the coal in any but British bottoms? No, and very properly he would specify that the coal was to be delivered in English ships. We are so accustomed to being the "International Good Thing" that we overlook the fact that this might be an opportunity to keep this $225,000 freight money in our own pockets. It is particularly interesting in connection with this order to note that the money for the freight is to be paid by the French government as the coal is to be used on their own railways, and so far as can be ascertained, there has been no interest paid on the huge war debt which France owes to this country, not to mention any attempt having been made to fund the principal as Great Britain has already done.

This money so generously loaned was obtained from the sale of Liberty Bonds and has not yet been repaid. As the bonds become due, it will be wrung from the pockets of every one of us now alive and probably from the pockets of our children and grandchildren. Each man, woman and child in the United States today is contributing by taxation, directly or indirectly, to paying the interest on these bond issues. Is it not time that "self-interest" should assert itself in this county? We are the most generous people on earth and we are all proud of it, but there comes a time when generosity is carried to an extreme. Those of us who pay direct taxes are complaining bitterly about the high cost of all commodities and we will never see the cost of living come down to normal conditions, until its prime cause, excessive taxation, is ameliorated.

In the case of the carrying of this coal abroad, if it were carried in government-owned ships and not a cent profit was realized in the transaction, the men who operate the ships, who furnish their supplies, and who make their repairs, would at least be making living wages and could help in paying taxes to be used in settling bond interest, which must be paid periodically, as the result of our generous impulses in loaning money to our European friends when they were in trouble. There should be justice in all transactions, and instances of this kind illustrate why we should be just to ourselves.

American Ships Successful in Coffee Trade

One of the finest examples of this kind is exemplified in the great American coffee cup. For years every American

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who drinks coffee at breakfast has been paying tribute to foreign shipowners as no coffee is raised within our own continental borders. The great bulk of it has been and is now shipped from Brazil. Prior to the Shipping Board's establishment of lines to South America, the vast quantities of this staple commodity were carried to our shores in foreign bottoms. When we entered the coffee trade with our own ships, foreign competition, in order to scare us off from what they considered a vested right, reduced the cost to as low as 35 cents a bag from Santos to New York. Not scaring very easily, the Shipping Board continued these lines at a loss to the Treasury, and when it was seen that we were exercising our rights in this great trade, the freight rates have been advanced to what is a reasonable return from the shipments, and what is undoubtedly a much lesser rate than would now be prevailing, if there were no American ships in the business. Today we are carrying over 70 percent of this commodity, and the money for that service is being kept in our own pockets where "self-interest" dictates that it should be.

It is pleasing also to note what a little "self-interest" is doing in regard to our exports. Prior to the time of starving these South American lines, our exports to our American neighbors were almost negligible. Europeans, having ships, grabbed the business from under our very noses. Today, after only five years of American ship service, our exports southward have advanced by leaps and bounds. We now control the automobile trade in all countries of South America where American ships touch. See how far-reaching that one item of export is to our national prosperity. Thousands of people all over the country, but principally in the mid-West, have benefited by our increased sale of motor cars in a market which we had barely touched, and could barely reach before the advent of American ships to South American ports.

Of all our great industries which make us the most prosperous nation in the world, none will pay greater returns to the people at large than to maintain and build our own ships to extend our foreign trade. Self-interest in these lines of our industry will indeed be "good business" no matter how you approach it. Let us all take seriously the advice of Polonius to his son, "To thine own self be true."

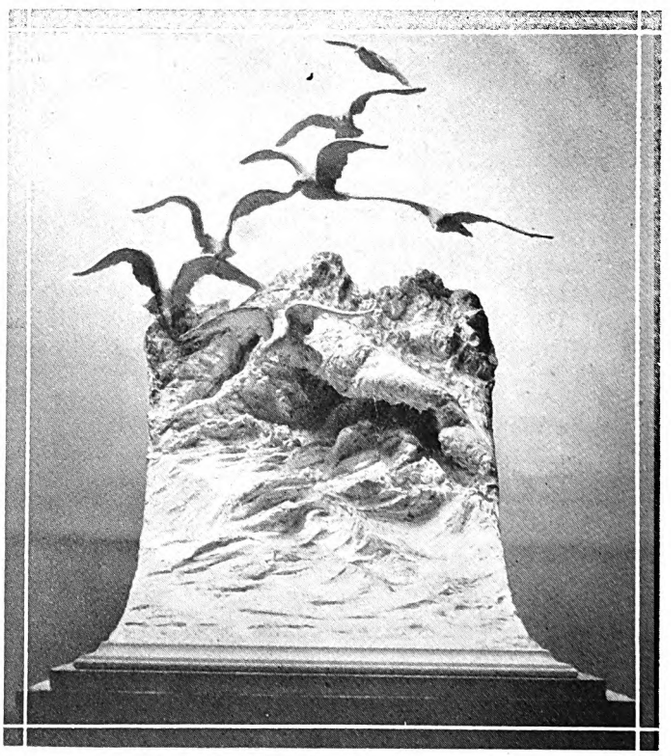
Navy and Marine Memorial Dedicated to Americans Lost at Sea

WHILE the vital part played in our national life by the Navy and the merchant marine is fully appreciated by all thinking individuals, a public and national recognition of it is lacking and greatly needed. Innumerable memorials have been erected to commemorate various kinds of service in national life and activities in war and peace by exalting in tablets, medals and monuments of all sorts, deeds and virtues of individuals reflecting the ideal of sacrifice and worthy endeavor. However, service on the seas by the Navy and the merchant marine, though enormous in its portent and fraught with dangers and with great sacrifice, seems to have passed without appropriate national recognition. A movement is now on foot for the erection of a Navy and marine memorial to be dedicated to Americans lost at sea and to service on the seas.

The national committee which was formed to further the plan to erect this memorial includes: Col. Roosevelt, assistant secretary of the Navy; Admiral Benson, United States Shipping Board Commissioner; Chairman Farley, of the United States Shipping Board, and many others prominent in civil life and in the service. The executive committee of this naval memorial movement includes Col. Robert M. Thompson, Admiral Fiske, Walter Firth and others.

Preliminary information obtained from the historical section of the Navy Department indicates that the casualties in naval and merchant vessel service during the war amounted to 299 ships flying the United States flag. The Americans lost in these vessels numbered 1,745. The total casualties in the United States Navy personnel during the war amounted to 7,367 officers and enlisted men, while the number of American troops lost at sea while being carried to the other side on foreign ships is very large. In addition, there were many non-combatants who lost their lives on torpedoed passenger vessels.

These great losses on the sea and the thought of the solitude and silence that surround them have inspired a monument of strictly marine character. The monument represents a wave or section of a wave with seven seagulls hovering over it. It is to be cast in bronze and the dimensions will be 19 feet by 29 feet by 32 feet. When mounted on its pedestal and foundation of marble the monument will be, from the ground to the topmost bird, 42 feet high. The greenish



Model of Navy and Marine Memorial

and blue patinas of the bronze will naturally reflect the colorings of the sea.

The work is of masterly execution and in its inspiration and conception opens up a new field in the history of creative art. It will in itself establish a permanent art interest in marine affairs for the country and show our gratitude for acts of bravery, the risks taken by sailors at sea and the long and faithful service of our Navy.

The monument design received favorable comment from artists and critics during its exhibition at 12 West 8th street, New York City, where it was shown in the studio of Daniel Chester French, the sculptor. Those who have seen it have expressed the opinion that it should be erected as a national monument, as a fitting memorial to Americans who have died in service on the seas.

The Capitol at Washington has been considered the most favorable location for such a memorial because it is the center of national interest, because it is readily accessible and because it would afford the serene background appropriate for the monument.

Any further information desired will be gladly furnished by A. M. Graham, 125 West 11th street, New York.

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Shipbuilding in Great Britain Now at Lowest Ebb

Improvement Depends Upon Clearing Up of European Politics and International Relations and Absorption of Surplus Tonnage

By James Swan*

THE present unfavorable situation in the shipbuilding industry in Great Britain is the result of many different influences, all arising more or less directly from the war and the general state of disorganization left in its wake.

The unsettled conditions on the continent, particularly in the Ruhr valley, make a general and orderly revival of European trade at present impossible, and this affects more or less directly all other trade routes. The delay in general economic revival, more than any other single influence, is causing the unprecedented lack of demand for tonnage.

Of scarcely less influence upon the situation is the surplus of tonnage caused by the tremendous production of merchant vessels during and directly following the war, not only in Great Britain but in other countries which up to that time had not held important positions in overseas trade. The net result of this great shipbuilding activity, notwithstanding the enormous losses of ships due to submarine attack, has been to give the world in 1923 a far greater merchant tonnage than existed in 1914 and this in the face of a most acute trade depression.

It is not to be wondered at, in view of the conditions cited, that British shipping and shipbuilding activities are today at a low ebb, nor is it possible to foresee any substantial improvement until the horizon of European politics and international relations has cleared and the existing surplus of merchant vessels shall be absorbed.

Probably there has never been a period, certainly not within the memory of those at present engaged in the industry, when British shipbuilding has been at so low an ebb as now exists. Furthermore, it does not seem possible to predict, even in the vaguest manner, when a material improvement in conditions may be looked for. The general opinion appears to be that the lowest point of the "slump" has been reached and that any change will be for the better but few will venture any prediction as to when a change will come.

Labor Situation Another Drawback

Concurrently with the depression already mentioned, which is world-wide in its effect, the British shipping industries are confronted by other difficulties at home. Chief among these is the labor situation. While strikes and similar agitations are by no means confined to Great Britain, they appear to be more far-reaching and of more serious and sinister effect there than elsewhere. Notwithstanding the low ebb which the business has reached and the dearth of new orders, there are still a considerable number of ships under construction and promise of some more, which will have to be built if existing lines and sailing schedules are to be maintained. One would suppose that at such a time the workers would be thankful for the little work that is in hand and by their efforts contribute to its execution promptly and economically. On the contrary, this peculiarly inopportune moment has been chosen for the declaring of a boiler makers' strike and in consequence nearly every shipyard is practically tied up and work has ceased, to the very great financial loss, not only of the workmen themselves but of the owners of the yards as well and of the other industries more or less dependent upon them for support.

Bad as is this situation in its present effect, it is having a deeper and more serious influence. Continued unemployment is forcing the emigration to America of large numbers of skilled shipyard employees. Particularly is this true of the Clyde district where every outgoing ship is reported to be filled. These men, had they remained at home, would have continued in idleness, with no trade other than their own open to them, such is the strength of precedence and habit as well as union organization in the "Old Country." Once in the United States or Canada, however, unlimited opportunities exist, as a really skilled shipyard mechanic is useful in many different lines. This flow of emigrants is a matter of national importance and is being viewed with grave concern by those who have Britain's commercial welfare at heart.

As is usual in periods of industrial unrest, the productive efficiency of the men has suffered, and British shipyards are, as the result of the keen competition brought about by the small amount of work offered, losing many contracts, particularly in the line of repairs, to German and Dutch concerns. It is only too apparent that, if Great Britain is to retain her position in the shipbuilding world, she will have to put her industrial house in order, and that in the near future Germany, once her present difficulties are settled, will prove a more formidable competitor than ever and one which can be successfully met only by the best of cooperation between employer and employee and hard work on the part of both.

Ships Under Construction

Turning to the detail of what is actually being done in shipbuilding; there is a small amount of work under way, mostly, up to the present, consisting of replacements of liners and similar large vessels lost during the war and necessary in order to continue established services. There are also some cargo vessels built and building for companies which maintain regular schedules, although it is doubtful if any of them can make money under present trade conditions.

Coming to the more technical or engineering side of the shipping business, the Diesel engine, in its various forms, is probably the most important question before British shipbuilders and operating engineers at the present time.

It is generally admitted that the Diesel has passed the experimental stage and has now entered upon a period of development, but it is pointed out by many shipowners that there are certain drawbacks or limitations to every type so far developed and that there is rather a long road yet to travel before anything approaching a standard type of engine is arrived at—in other words, a Diesel which represents a degree of development in internal combustion engines, similar to that held by the triple expansion engine in steam engineering.

Uncertainty as to the type of engine best to adopt, doubts

*Editor of Marine Engineering and Shipping Age.

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as to the possibility of obtaining a supply of suitable fuel oil at all ports and the difficulty of obtaining trained engineers all contribute to an attitude of doubt in the minds of many shipowners as to the advisability of large investment in motorships. There is, however, such a small demand for ships of any type that it is not possible to say what the policy might be were trade conditions normal and shipping a remunerative investment.

In the meantime, a most active interest is taken in motorships and everything connected with them. Various types of Diesel engines are being developed by different builders, and there are several which give satisfactory results. By far the larger number at present in use are of the four-cycle type, but the two-cycle seems to be regarded with increasing favor, although it has not as yet had the benefit of such extended use, and consequent operating experience, as the four-cycle.

In general, the superior economy of the Diesel engine is readily admitted and its eventual general adoption considered as certain, but until trade conditions have greatly improved and the demand for ships is such as to justify the greater expenditure involved, an extended adoption of this class of machinery does not appear probable.

Owing to the very considerable weight of the Diesel engines at present being commercially produced, their use has been practically confined to vessels of relatively low power, although at least one large motor passenger ship is under construction. It seems altogether probable, however, that installations of Diesels in high speed ships of great power will become a possibility in the not distant future. Double acting engines of both the four-cycle and two-cycle types are now under construction or in experimental operation which promise a very considerable reduction in weight per horsepower, and this, coupled with the great saving in weight of fuel and fresh water made possible by this type of machinery, would seem to indicate the early advent of the Diesel-driven passenger liner.

THE SUPPLY OF OIL FUEL

The question of oil fuel supply, both for motorships and oil burning steamers, is receiving much attention. In some quarters, the permanency of this supply is apparently looked upon with some doubt, although with the Persian oil fields at her command it would seem that Great Britain has little to fear on this score. Many leading engineers and shipowners are of the opinion that oil is too valuable to be used for the generation of steam in any ships other than those of relatively high power, and that cargo vessels, particularly tramp steamers, should use only coal. The necessity of conserving the available supply of fuel oil is being advanced as an argument for the adoption of Diesel engines, but until oiling stations are distributed along the world's trade routes to meet all possible requirements, the general use of these engines in tramp steamers appears doubtful.

TRADE DEPRESSION GIVES OPPORTUNITY FOR SCIENTIFIC DEVELOPMENT

There is one feature of all periods of trade depression which should not be overlooked, and that is that opportunity is given for technical and scientific investigation and development not possible under stress of great production and the endeavor to turn out a maximum amount of work. That this is being taken advantage of in England today is evidenced by the work of Diesel engine builders and also by the movement to introduce standardization of ship machinery and fittings.

There can be no doubt of the eventual revival of the world's shipping business and that Great Britain will have her share in this revival goes without saying.

Its shipping is necessary to the existence of the British Empire and that this shipping will be maintained at all costs cannot be doubted, even though the revival and future development are in the face of more serious competition than has heretofore existed.

Get Out of the Shipping Business

WE trust the coming congress will disentangle its common sense from its politics long enough to get the government out of the shipping business.

The United States is not socialist. Our people in the main do not want the government to run business, although under one provocation or another they have permitted a considerable extension of political control over private activities. But the business of shipping is about the last industry which a government is fitted to manage. Success in building up and operating profitably a merchant marine can only be won by a complicated combination of private initiative, world-wide knowledge and experience of transportation, traffic and merchandising. Its problems are many sided and fluctuating. No sensible man who knows anything about the conditions with which the expert in shipping must deal can hope that a government bureaucracy, even if it could be free from political pressures, could evolve or direct successfully a great national marine.

We believe every man in congress, except a few impracticals or politicians hoping to win votes on the government ownership appeal, realizes this to be the unquestionable fact. Then why not have the courage to act up to it and stop now the money waste of government operation and the injury to private enterprise which government operation inflicts?

The first loss to us is told in statistics. The second cannot be, but it is a worse evil. We cannot hope for a vigorous growth of American shipping as long as private enterprise has to fight the unlimited resources of the government. The whole nation is injured by this obstruction. It should be removed without further procrastination, even though a large sum has to be charged off on our books to get free. It will not be as large a loss as we are suffering and will continue to suffer from the continuation of government management.
—The Chicago Tribune.

TO COOPERATE WITH DEPARTMENT OF COMMERCE.—With a view to establishing an effective point of contact between associations interested in the merchant marine and the Department of Commerce as to lighthouse, steamboat inspection, coast survey and navigation questions, a committee has been appointed to represent the associations.

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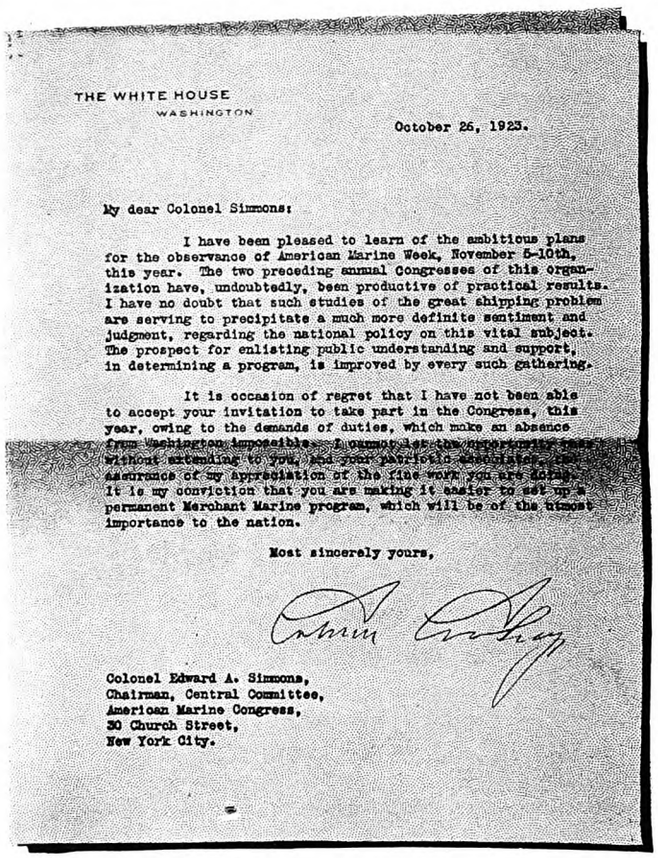
American Marine Congress Adopts Resolutions Outlining Constructive Policy for Merchant Marine

Consolidates Views of One Hundred National Organizations into Shipping Program for Guidance of National Legislators—Plans Permanent Organization

THE Marine Congress which assembled at the Waldorf Astoria Hotel in New York City on November 8 at the invitation of the American Marine Association to work out a practical plan for the development of the American merchant marine was attended by representatives of about one hundred organizations directly or remotely interested in transportation by water. Col. E. A. Simmons, chairman of the Central Committee, presided and in his opening remarks told his hearers how warmly the late President Harding had supported the movement and read the letter from President Coolidge reproduced on this page showing the appreciation of the Administration for the efforts which the Marine Congress is making for the development of American shipping.



THE WHITE HOUSE
WASHINGTON

October 26, 1923.

My dear Colonel Simmons:

I have been pleased to learn of the ambitious plans for the observance of American Marine Week, November 5-10th, this year. The two preceding annual Congresses of this organization have, undoubtedly, been productive of practical results. I have no doubt that such studies of the great shipping problem are serving to precipitate a much more definite sentiment and judgment, regarding the national policy on this vital subject. The prospect for enlisting public understanding and support, in determining a program, is improved by every such gathering.

It is occasion of regret that I have not been able to accept your invitation to take part in the Congress, this year, owing to the demands of duties, which make an absence from Washington impossible. I commend to the [illegible] without extending to you, and your patriotic associates, the assurance of my appreciation of the fine work you are doing. It is my conviction that you are making it easier to set up a permanent Merchant Marine program, which will be of the utmost importance to the nation.

Most sincerely yours,

Colonel Edward A. Simmons,
Chairman, Central Committee,
American Marine Congress,
30 Church Street,
New York City.

President Coolidge's Letter to Marine Congress

After extended deliberation the Marine Congress adopted twenty-two resolutions outlining a constructive policy for American shipping. The resolutions reflect the general opinion that the merchant marine should be privately owned and operated and that the Government should retire from active participation in the operation of mercantile vessels. Furthermore, the universal wish was expressed that the potential menace of a large and uneconomical fleet of idle vessels should be removed, and that the Government should immediately dispose of the large number of its vessels which have no value as competitive units.

The resolutions adopted were as follows:

RESOLUTION No. 1

Part A. Resolved that the United States Shipping Board and Emergency Fleet Corporation should retire from the business of operating ships, and place the operation in private hands, at the earliest practicable date.

Part B. Resolved that the United States Shipping Board should immediately scrap such vessels as are inferior in design, equipment or condition.

Part C. Resolved that the Shipping Board should offer its remaining vessels for sale to American citizens without any restrictions, and without discrimination between buyers and ports.

Part D. Resolved that after the lapse of a reasonable time all of the vessels not sold under the foregoing plan and having no immediate prospective sale value, should be scrapped.

Part E. Resolved that there are some freight and passenger and mail services maintained by Shipping Board vessels, the continuance of which may be considered as essential to our national interests. If the Shipping Board is unable to find buyers for the vessels in such services, they should be placed in private hands under an operating arrangement until buyers can be found or developed or the impossibility of profitable operation be definitely established.

RESOLUTION No. 2

Resolved that American shipping should be conducted by private American owners and that all merchant ships owned by the Government should be transferred as rapidly as possible to private ownership. Under no condition should government owned lines compete with private lines but, if for the purpose of expanding our trade, new lines are established by the Government, they should be as rapidly as possible transferred to private ownership.

RESOLUTION No. 3

Resolved that the Secretary of Commerce and the United States Shipping Board be requested to proceed to have the navigation laws of the United States modernized, codified and made comparable with those of our successful maritime competitors.

RESOLUTION No. 4

Resolved that the unparalleled success which has attended the reserving to American ships of first our own mainland commerce and that of our commerce with Alaska, Porto Rico and Hawaii, justifies and demands the prompt extension of that national policy to our own commerce with the Philippines.

RESOLUTION No. 5

Resolved that we urge the adoption of a national policy reserving the transportation of not less than one-half of the total number of immigrants admitted to the United States in any fiscal year to vessels registered or enrolled and licensed under the laws of the United States.

RESOLUTION No. 6

Resolved that we favor the enrollment under suitable regu-

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lations as to pay, qualifications and duties of officers and men of the Merchant Marine in the Naval Reserve of the United States.

RESOLUTION NO. 7

Resolved that we favor the carriage of governmental officials and employees and supplies by privately-owned American ships and the restriction of ocean travel by government officials and employees to American ships when available.

RESOLUTION NO. 8

Resolved that we heartily approve the enlightened policy of the Post Office Department under the Merchant Marine Act of 1920, and that we strongly urge the Department to continue to transmit the mails by American steamers whenever this can be accomplished with the least possible delay.

RESOLUTION NO. 9

Resolved that the rail and ocean transportation media be drawn together and made to function as one transportation system to all parts of the world; and be it further

Resolved that permission be given to railroads and American steamship lines to enter into cooperative agreements to divide their said joint rates in a manner similar to that universally pursued in the division of rates on domestic and traffic via Canada; and be it further

Resolved that such arrangement shall not be permitted with respect to American railroads and foreign steamship lines.

RESOLUTION NO. 10

Resolved that an earnest effort be made on the part of the Administration to amend existing treaties with a view of the establishment of preferential customs duties on goods carried by American ships and tonnage dues paid by American ships.

RESOLUTION NO. 11

Resolved that a system of preferential rail rates for goods and passengers carried in American ships be made effective.

RESOLUTION NO. 12

Resolved that we adopt the policy of allowing our railroads to apply export rates on materials used in the construction of American ships and on supplies used therein.

RESOLUTION NO. 13

Resolved that it is essential to the permanence of the American merchant marine that American ships be properly built, manned, equipped and operated, and that all equipment and appurtenances be kept at a high state of efficiency and that the cargoes carried be properly loaded, safely carried and delivered; it is recommended that a proper uniform load line law be enacted, and it is further recommended that all American vessels be classified in the American Bureau of Shipping; and that loading of cargo be inspected by the Board of Underwriters and a loading certificate be obtained in the case of vessels engaged in overseas trade, and that the vessels be insured in the American Marine Insurance Syndicates, and that in the event of any loss or damage the services of these associations be immediately availed of.

RESOLUTION NO. 14

Resolved that the National Congress repeal all laws that admit foreign-built ships, including yachts, to American registry, and eliminate the 10 percent excise tax on pleasure boats built in this country.

RESOLUTION NO. 15

Resolved that the practice of placing contracts for repairs to government (other than naval) vessels on a basis of estimated cost without guarantee, in competition with bids of private interests, is unfair and should be discontinued.

RESOLUTION NO. 16

Resolved that the chairman of the United States Shipping Board be requested to have prepared and cause to be released as public information a report of the recent survey of its idle or other tonnage suitable for conversion into vessels equipped with oil engines, and to include therein a fairly comprehensive statement of physical condition of such vessels. That the Construction Loan Fund established by the Merchant Marine Act of 1920 be made available for loans for the conversion of suitable government owned steam vessels to motor vessels and for equipping them with such new auxiliaries as this conversion would necessitate. That purchasers entering into agreement for such conversion shall be enabled to borrow, from the fund named in above paragraph, to an amount not exceeding two-thirds of the cost of complete conversion under the same terms and conditions as are now provided for in case of new construction. Such costs of conversion to include shipyard charges for installation and necessary repairs and alterations to hull as well as the costs of main engines and auxiliaries, while the remaining one-third of all such costs are to be borne by the purchasers.

That the government be encouraged to continue to sell such vessels for such conversion under the most advantageous terms to the purchaser.

RESOLUTION NO. 17

Resolved that the Congress strongly endorse the movement for elimination of waste and simplification of practice initiated by the United States Department of Commerce, the American Marine Association, the United States Shipping Board Emergency Fleet Corporation and the representatives of the marine industries and the organization by them of the American Marine Standards Committee.

That the American Marine Standards Committee be commended to the interests in the marine field, for their encouragement and support, as a proper organization to point the way to needed economy in the design, construction and operation of ships and port facilities and allied industries, and one which, if properly encouraged and supported, can accomplish much to lessen the economic handicap with which our Merchant Marine is at present hampered and also to promote the construction of American ships in American shipyards.

RESOLUTION NO. 18

Whereas a comparison of area and population of Europe as a whole and the United States discloses that although of similar area and commerce the United States has comparatively few well developed ocean and inland waterway ports while Europe has many, serving every section of its coasts and interior, and

Whereas the inevitable growth of the population and commerce of the United States will require many well equipped ocean gateways, therefore

Be it resolved that it is the consensus of opinion of the American Marine Congress that the development of an adequate number of ports be encouraged and that to that end equitable ocean and rail class and commodity rates for exports, imports, coastwise and intercoastal trade to and from such ports on an equitable basis be established and maintained.

RESOLUTION NO. 19

Resolved that all bureaus of the Department of Commerce having to do with merchant marine affairs be consolidated under one head within the Department of Commerce.

RESOLUTION NO. 20

Resolved that American citizens who travel abroad for business or pleasure, individually and collectively, including business and professional associations taking part in foreign

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conventions, athletic teams, merchants and manufacturers who ship to and receive goods from foreign countries and all other American citizens who travel and ship by sea should consider themselves bound by patriotic duty to patronize American ships.

RESOLUTION NO. 21

Resolved that in view of the fact that liquor smugglers can readily transfer their present registry from the British to the French or Panaman or other foreign flags, and in view of the fact that most liquor smugglers at the present time are accustomed to anchor more than 12 miles off shore, and in view of the fact that the proposed treaty with Great Britain will give British passenger ships an advantage over all other ships including American, we earnestly urge the Senate of the United States in the interests of fair play to American shipping, to reject the proposed 12-mile treaty with the British Government.

RESOLUTION NO. 22

Whereas undoubtedly the American Marine Congress is especially interested in all matters pertaining to shipping, and therefore is vitally concerned with our export trade which makes such shipping possible, they have therefore a vital point of contact with all other organizations interested in promoting foreign trade, and should cooperate to the fullest extent with these associations and with the proper governmental departments. We appreciate the force of public thought that may be created at such meetings as this, and the influence that discussions at the sessions and the resolutions that may by adopted by the Resolutions Committee play in the affairs of the nation. Much good can be done in cooperating with the various associations that have made this Congress possible and can assure you that this committee, having been appointed by the American Manufacturers' Export Association, will do all in its power to bring to the attention of that association any resolutions adopted by your Resolutions Committee for such investigation, study and recommendations as apply specifically to the purposes of their organization, which is—*to foster foreign trade.*

Be it therefore resolved, That the present Central Committee of the American Marine Congress take immediate steps to make permanent this first American Marine Congress, in accordance with the expressed desire and general thought expressed in its session.

A Remedy Proposed for the Shipbuilding Situation*

By Joseph W. Powell†

IN the years before the war our principal shipyards depended on naval contracts for the back log of their shipbuilding. The Limitation of Armament Conference definitely closed our naval expansion for years to come. The United States Shipping Board holds for sale a vast fleet of tankers, cargo vessels and passenger boats, and until this fleet is disposed of, the building of new vessels, except of special types, is rendered nigh impossible. Three years of falling freight rates and short cargoes have left few shipping companies in financial position to buy new tonnage even if they had the desire. In time, high railroad freights will act to increase water transportation in coastwise and intercoastal trade and will some day place these services on a remunerative basis. In the growth of this trade our shipbuilders can hope for a reasonable volume of orders. At present, the million gross tons of intercoastal shipping is not carrying full cargoes, but five years from now I believe two or three times this tonnage will find lucrative occupation on this route. This should mean a quarter of a million gross tons of new ships annually in this trade alone. Besides the Shipping Board's enormous fleet, there are on the ocean over six million gross tons of American flag ships. Beyond the new tonnage for intercoastal service this private fleet should purchase 300,000 tons per annum for its upkeep and expansion. So, once through the present depression, shipyards should be able to count on a building program of about 450,000 gross tons a year. To be optimistic, let us double this total which should take care of any building to meet favorable shipping laws that may be enacted, as well as all other causes.

What does such a program as this mean in terms of present building capacity? Barring another war, it is a fair prediction that as at present organized this industry cannot operate at 40 percent in any one year in the next five. This means excessive costs made worse by cut-throat competition. It means for many yards a process of starvation and eventual extermination. A shipyard is a difficult property to operate for any other business purpose than shipbuilding. Uses may be found for boiler and machine shops. Steel shops may be employed in car building, and miscellaneous work for foundries, pattern shops and pipe and sheet iron shops may be found as makeshifts to reduce losses from idleness. But, at best, these shops are ill adapted to any special work except that for which they were designed, nor do these outside jobs go well with shipbuilding endeavors.

This gloomy picture is of little avail, if there is no remedy to offer. Shipbuilders cannot go far in making more new shipbuilding business, but they can control within reason the business that is offering. They cannot hope to fully employ their total capacity, but they can reduce this capacity. When the Harriman interests found that their two shipyards could not be kept half full, they made one of the most constructive moves since the war, by accepting the drastic expedient of shutting up completely one of the yards and concentrating their work at the other. If the present yards are to operate independently, there is little hope of the concerted action necessary to improve present conditions. Too many divergent factors enter the problem. But if several large combinations of principal builders could be effected, the first step towards a solution would have been accomplished. With a large majority of the industry in, say, three combined companies, these combinations should shut down and dismantle the proportion of their building capacity, the most important move in righting an impossible situation. Then by exchange of estimates of cost on all new work *before* bids are submitted and exchange of *actual cost* on completed work, bid prices could be brought within reasonable limits and the present disgraceful competition stopped.

I do not underestimate the difficulty of carrying through this proposal. Closed yards mean lost positions, and it would be beyond human nature to meet such proposal free from bias. The difficulty of adjusting values and agreeing to any combination can be magnified by want of belief in the proposed remedy, and many other good reasons can be advanced against any drastic action. But the cold facts of the situation still endure and, if my analysis is nearly correct, lead to one end. We shall await with deepest interest the solution to this problem.

* From an address delivered at the annual banquet of the Society of Naval Architects and Marine Engineers in New York, November 9.

† Former president, United States Shipping Board, Emergency Fleet Corporation.

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An Adequate Merchant Marine Essential for the Nation*

The Future Greatness of the United States Depends Upon Increasing Her Commerce with the Outside World

By Rear Admiral Charles P. Plunkett, U. S. N.**

THE immediate problem which we face is not the building and supporting of a merchant shipping so much as it is a problem how to deal with what we now possess. Based on thorough information, the present seems to be a period of too much uncertainty and no probable future. It is not contended that the American people do not want a merchant marine. They not only want it, but their Congress has taken some of the steps necessary to provide it, and the policy which they have approved would provide for a suitable merchant marine. Unfortunately, there are features of that policy that would lead to endless embarrassment; namely, the denouncing of some of our treaties and the modification or cancellation of others.

The policy of direct and indirect aid to merchant shipping is not new. It has been applied by all nations, and is still being used by the majority. The application of it at this time is a question which we must consider. Nobody yet has accused the American people of trying to get something for nothing, but, undoubtedly, there are a great many people who, in discussing the question of the merchant marine and in refusing to give it the same consideration that we have given to other means of transportation which have been developed in the country, seem to think that the merchant marine can be brought to life and kept going on a profitable basis without any expenditure or contribution on the part of all the American people.

Failures Have Demonstrated Difficulties of the Problem

Undoubtedly, many private individuals have sunk their last dollar in an effort to demonstrate their capability to operate ships with little or no outside assistance. These efforts have only demonstrated the public spirit of these individuals, and their failure has not caused any great amount of comment among the great mass of the people, who seem to applaud only the successful. But these men have been successful for our purpose, for they have demonstrated the difficulties of the problem of placing upon the seven seas an American merchant marine, consisting of American-built ships, manned by American citizens, and carrying the products of American industry, all under the American flag! President Harding, in his address to a joint session of the Senate and House of Representatives on February 28, 1922, offered a perfectly feasible and proper plan to save our merchant marine.

Who can look back only as far as 1914 and not realize the immense importance of a nation's potential strength and resources in a proper merchant marine? Who can look back to 1917 and not realize the helplessness of the greatest nation on the face of the earth when confronted by a demand for help? Not help that you had all the time in the world to provide, even supposing you had all the money that you needed, but help that was needed instantly and in quantity.

Who does not believe today that, unless America gets behind her merchant marine, the elements combined with other features will reduce to a state of helplessness that with which we found ourselves possessed at the end of the Great War? What is to become of our building and repair yards? Just suppose they have to go out of their present business. How long will it take to gather the necessary technical and operating forces to again produce and maintain shipping?

No one in America is predicting war, but everyone in America is thinking of a greater America! Upon what lasting, peaceful basis can America ever be greater, except through the increase of her commerce with the outside world? And upon what basis can she derive that greatness except through the ownership of a merchant marine capable of handling at least fifty percent of that commerce in order to keep down the exorbitant and excessive rates which would certainly follow foreign domination of our sea-borne commerce, not to mention the thousand-and-one little discriminations in trade all over the world, all of which react against the American producer and farmer?

Merchant Shipping Is More Than a Second Line of Defense

We of the Navy can operate away from the coast of the United States just as far as the American merchant marine can support us, and no farther. If the Navy is our first line of defense, then the merchant marine is so near to it that it is not entirely a second line of defense! It is so nearly in the trenches with the Navy that it can hardly be called a second line of defense.

Nobody begrudges the other nations the success which they have attained in ocean-borne commerce, but the American is not an American who idly sits by and sees his business carried on by other nations in a manner and after a style dictated by our industrial and agricultural competitors.

There is no reason, except utmost emergency, which should warrant an American citizen to take passage for any port in the world on other than American vessels, nor should there be any reason why more than half of the ocean-borne commerce of this country should travel under any other but the American flag!

The time element is the most expensive element entering into human life. No one should ever work on a basis that they have plenty of time. It is entirely reasonable to use adequate time where a big decision is to be made, but the American people have decided that they want an American merchant marine—the decision in this case has been made. Are we to allow the time element to absolutely and utterly destroy that which is absolutely essential that America can maintain herself in security in time of peace and also in time of war?

Bankers' Committee on Marine Securities.—Recommendations that the government should retire from the shipping business as soon as possible without interfering with existing needs of trade, and that the La Follette seamen's act and other laws which tend to increase the cost of ship operation should be modified, were contained in the report of the committee on marine securities adopted at the annual meeting of the Investment Bankers' Association held at Washington on October 31. The committee also expressed the opinion that a definite statement of policy should be made by the Shipping Board that it will remove government competition on any essential trade route which will be taken over by private interests. The committee believes ways and means must be found to finance the shipping business conservatively.

*From an address delivered at the Marine Congress Banquet at the Waldorf-Astoria Hotel, New York, November 8.

**Commandant of the Third Naval District, New York Navy Yard, Brooklyn, N. Y.

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General View, Main Aisle, Marine Exposition

New and Interesting—

devices shown for the first time at the annual Marine Exposition, held at the Grand Central Palace, New York, November 5 to 10 under the auspices of the American Marine Association, are illustrated and described in the following pages, together with views of many of the exhibits at the Exposition. As indicated by the large number of new products displayed and the great variety of exhibits, the Marine Exposition this year marked a notable period of progress in the marine industries and reflected in no uncertain way the growing interest of the nation in maritime affairs.

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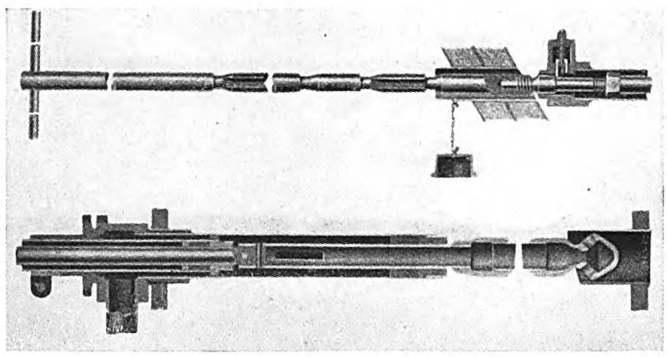
EXHIBITS AT THE MARINE EXPOSITION

Rear End Front-Operated Soot Blower

A SOOT blower of the Diamond type, designed especially for cleaning the rear end of Scotch marine boiler tubes and operated from the front, was shown at the booth of the Diamond Power Specialty Company, Detroit, Mich. The principle of cleaning Scotch boiler tubes by these blowers is to blow the soot with the draft up the stack.



Cross Section Type BBM Diamond Soot Blower

It was specially developed for double end Scotch boilers or for a single end boiler so close to a bulkhead as to prevent the installation of the rear end type blower.

The model BBM blower may be installed in boiler tubes of 2-inch inside diameter and larger. It is housed in the boiler tube proper, the units nearest the center of the tube bank being selected where possible. Operation is by means of a removable handle, which passes through the uptake doors and engages a simple mechanism, which permits the blower to be advanced through its enclosing tube back into the combustion chamber, step by step, at the same time being rotated about its horizontal axis. Through the combination of these two motions, the steam jets describe constantly-widening cones which clear the tube surfaces. After blowing, the blower is drawn back into its protecting tube by a straight pull and the operating handle is detached.

Automatic Feed Water Regulator

THE Babcock & Wilcox Company, New York City, demonstrated a new type of patent automatic feed water regulator at the exposition this year. It is claimed that by reason of its free circulation and the comparatively large amount of water it contains, the B. & W. watertube boiler requires generally little attention to keep a constant water level, and in vessels of the mercantile marine in which these boilers have been fitted, feed water regulators are frequently dispensed with. In large installations of boilers, however, it is preferable to fit them.

The new regulator designed for this service consists of a hollow cylinder, which is rotated on its axis by means of a float and lever placed inside the boiler. The cylinder has ports cut diagonally along its walls, and works in a liner having corresponding ports. The liner is fitted in a casting or box which is attached to the boiler shell, and has one branch for a feed check valve, and another branch for a pipe leading to a non-return feed valve located on the boiler drum.

The cylinder is moved lengthways along the liner by means of a suitable adjusting screw and spindle, the spindle being connected to the cylinder by ball bearings, so that friction is reduced to a minimum.

Attached to the spindle, between the adjusting wheel and the gland, is a lever and rod, the latter extending to a position in the stokehold, where it can be easily worked by hand from the firing level.

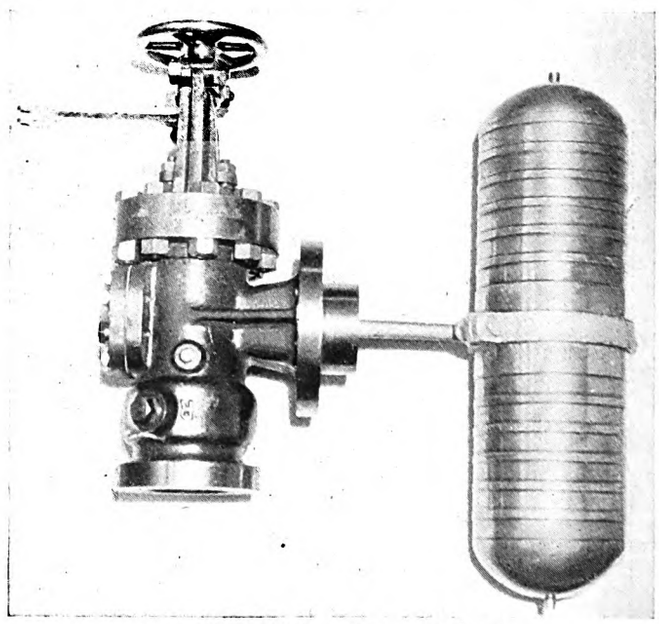
The action of the apparatus is as follows:

OPERATION

The feed water enters by the feed check valve into the hollow cylinder, and, if the water in the drum is low, passes through the ports of both cylinder and liner to the valve box, whence it travels through the pipe and non-return valve into the boiler.

The position of the cylindrical valve is entirely regulated by the float in the boiler. When the level of the water in the boiler is low, the ports will be open, and as the water rises in the boiler and carries the float with it, the cylindrical valve will be moved around, and the ports gradually closed.

The height of the level of the water in the boiler can be maintained at the position desired by moving the cylinder lengthways along the liner. This is done by turning the



Assembly of Feed Water Regulator

hand-wheel of the spindle attached to the cylinder, the travel of which, as the ports in both cylinder and liner are placed diagonally, will ensure an alteration in the point of cut-off relative to the position of the float.

There is a suitable indicator on the adjusting wheel showing which way it should be revolved for the higher or lower water level, and there is also an indicator on the spindle itself showing when the valve is at the highest, lowest, or any intermediate position.

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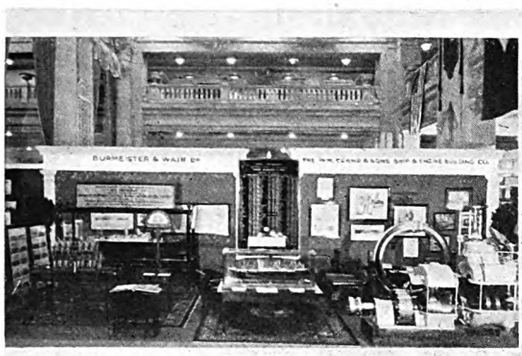

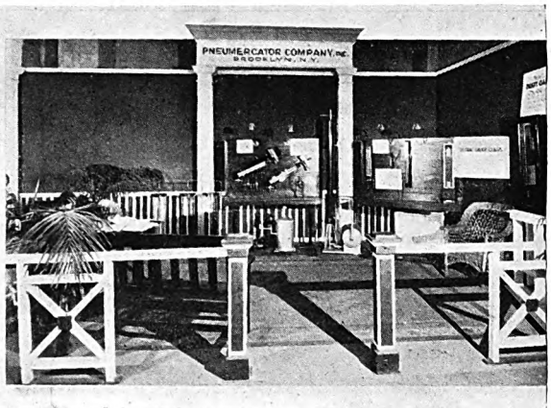

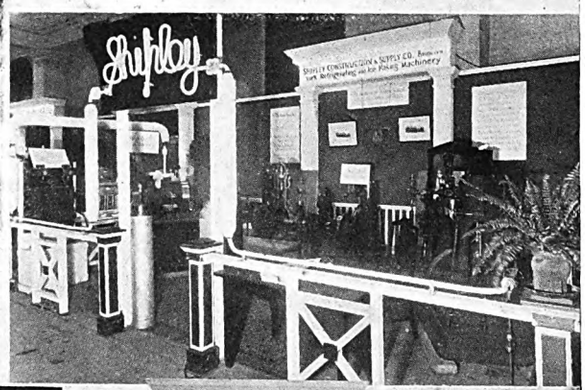

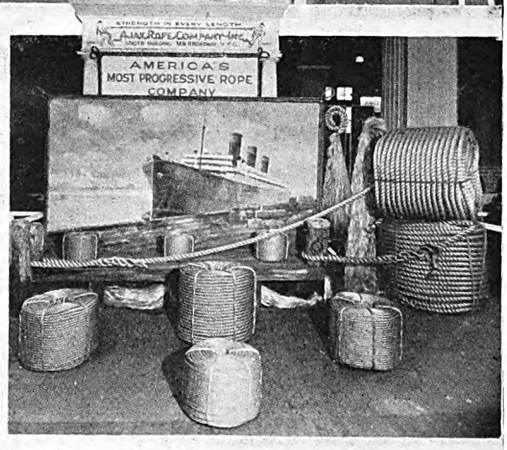

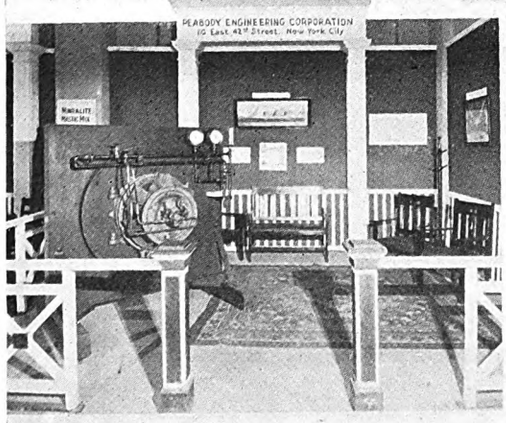

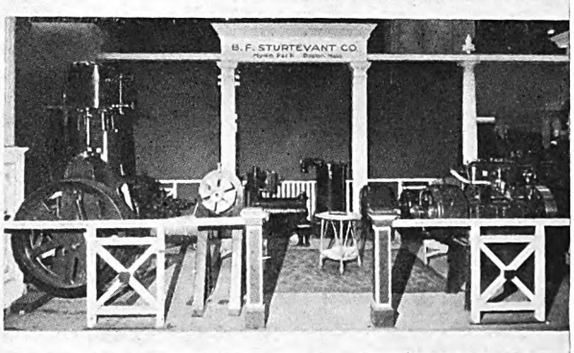

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EXHIBITS AT THE MARINE EXPOSITION

Improved Connecting Shackle

THE National Malleable Castings Company, Cleveland, Ohio, had on display an improved type of connecting shackle having the general design of a standard stud link. It is an ingenious device and can be used either in regular service or as a repair link.

Improved types of connecting shackles which are narrower in width than the old type, resulting in easier operation over the wildcat were also on exhibit.

New Asphalt Decking

THE James Coffey Engineering Corporation, New York City showed a section of "Minralite" Mastic flooring in its booth. This material is a high grade rock asphalt mastic combination of natural asphalt, refined and brought to the work in barrels, heated in specially constructed kettles and reinforced with mineral aggregate of various sizes, and carefully selected and graded.

This mix is then heated to the proper temperature and laid on the foundation which is to receive the mastic material.

It is stated that the method of laying "Minralite" Mastic and the preparation of the surface on which it is to be laid has been brought to a high state of perfection through actual practice and years of contracting and observation of the material in service.

The thickness of this floor depends upon the service required.

The features of this mastic as stressed by the company are that it is a preventative against corrosion; that it prolongs the life of the plates; and that the cost of maintenance is reduced.

Static and Dynamic Balancing

THE Vibrator Specialty Company of Philadelphia, cooperated with the Akimoff Propeller Company in demonstrating the combination static and dynamic balancing machine at the exposition. A 24-inch diameter bronze propeller was mounted and the method of operation explained. The machine can be instantly set for static or dynamic balancing and gives, as the company states, results of greatest accuracy. It gives the plane and the amount of correction to be applied to the body to make it operate smoothly *i.e.*, in short vibrations. Machines of this type find wide application in industrial plants to accurately balance crankshafts, flywheels, propellers, armatures, pulleys, etc.

Larger machines for balancing turbines and rotating fields, weighing up to 15,000 pounds are manufactured by the Vibration Specialty Company.

Not long ago the Vibration Specialty Company balanced five turbo-generators of the S. S. *Leviathan*. The portability of the machines made it possible to bring them into the turbo-generator compartment of the ship. Results were secured which exceeded all expectations.

The Akimoff Propeller Company also exhibited models of propellers built entirely along the lines of the circulation theory. These propellers look very much like any other but are developed on a radically different basis tending as it is claimed to unusually high efficiency.

Automatic Control for Cargo Winches

IN the General Electric Company exhibit at the recent Marine Show at the Grand Central Palace were included three pieces of apparatus of especial interest. These were a magnetic winch control, a portable, electric air compressor and a 500-watt turbine-generator.

All the electrical equipment for a single cargo winch installation was included in the magnetic winch control. This consisted of a General Electric type COM waterproof motor, with shoe type load brake especially designed for mounting on the open deck of a vessel where occasional submersion is to be encountered; a master controller of watertight construction, and a magnetic panel with accelerating contactors, overload protection and resistors mounted back of the panel. The panel was of the open type for mounting in a protected place.

This magnetic control is of strong construction, and is simply operated. It is superior to the drum controller handling motor currents due to the fact that the automatic contactors allow for the time element required in accelerating or decelerating motor speeds. The handle on the magnetic control can be moved easily and rapidly, whereas, on the drum controller, this operation must be done more slowly to definite points to prevent any possible burning of control fingers and segments and to allow an even movement of load.

An emergency switch is provided with this control, placed close to the operating handle. By means of this, the winch can be stopped in any position, the load brake set and the current cut off the motor.

The portable air compressor which was on exhibit is a compact, electric motor-driven machine to work from three to five standard pneumatic tools at once. With this device holes may be drilled up to 1½ inches in steel, seams may be beaded and calked and steel may be shaped by chipping. The greatest use on electrically equipped vessels would be in blowing and cleaning dirt or dust from the windings of electrical machinery, ordinarily inaccessible for hand cleaning. Another use is found in scaling surfaces preparatory to repainting. The motor takes three horsepower when charging the reservoir and is automatically governed to maintain the pressure between narrow limits. This unit will compress 35 cubic feet of free air per minute to 90 pounds gage pressure.

The CY 32-C turbine-generator shown by the General Electric Company at this exhibit is adaptable for providing current for various illumination purposes on tugboats and other small craft and as an auxiliary unit on larger vessels. It has a rating of 500 watts at 32 volts and operates at 3,600 revolutions per minute. The turbine, which is of the non-condensing type, has a special form of governor. A self-contained pressure regulator maintains a constant nozzle pressure with boiler pressures varying from 125 to 225 pounds or 70 to 170 pounds. The generator in turn maintains a constant load on the turbine by means of an eddy current brake coil which automatically compensates for any change in electrical load. The elimination of the usual type of mechanical governor simplifies the design so that there are but fifty separate essential parts in the entire machine and but one adjustment, that of the tension of the spring in the pressure regulator.

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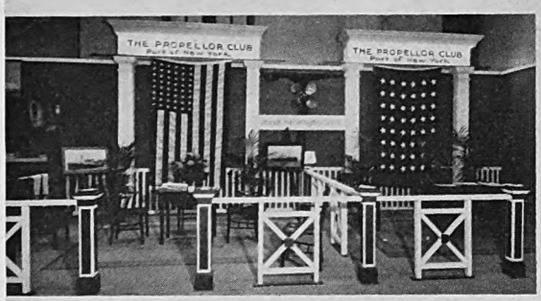
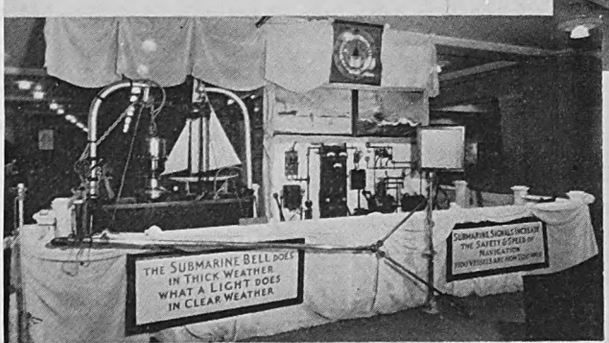
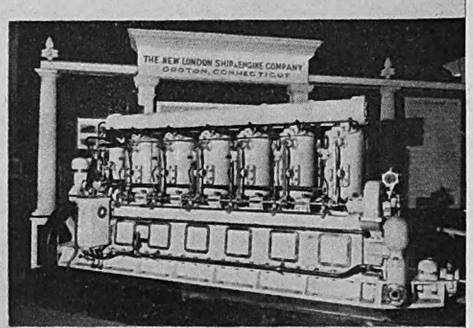
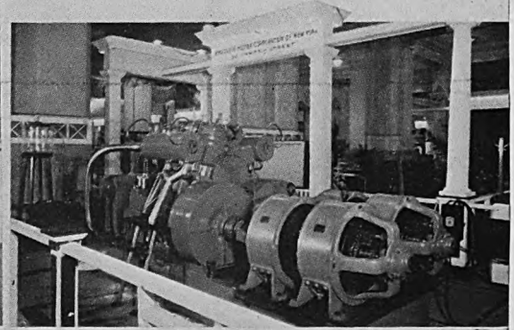
EXHIBITS AT THE MARINE EXPOSITION









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EXHIBITS AT THE MARINE EXPOSITION

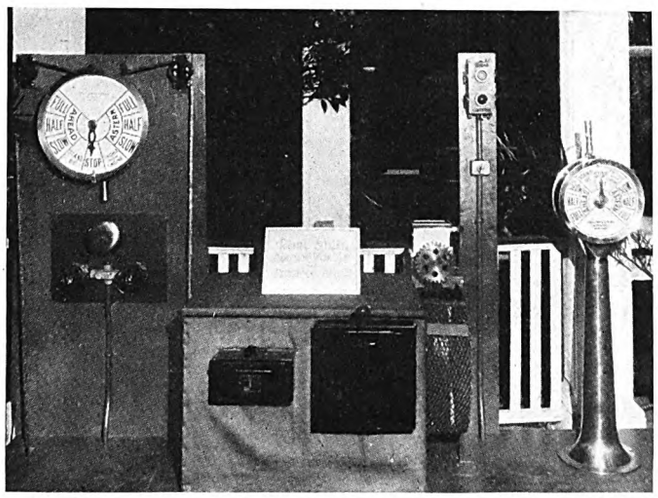
American Brass Company Has New Lead Covered Cable

THE American Brass Company, Waterbury, Conn., recently purchased the National Conduit and Cable Company, Hastings-on-the-Hudson, New York. This company is now known as the Hastings-on-the-Hudson branch of the American Brass Company. The principal new product being handled by the American Brass Company, made possible through this purchase, is lead-covered copper cable of many varieties used for power transmission service.

Bethlehem Corporation Producing Plant Mills Direction Indicator

THE Bethlehem Shipbuilding Corporation, Ltd., demonstrated the Plant Mills direction indicator and engineer's alarm at its booth this year. The rights for the manufacture of this device have been taken up by the Bethlehem people, who are manufacturing it at present at the Union Plant, Alameda, Cal.

This device is used as an aid and safeguard in maneuvering vessels at close quarters. The direction indicator keeps the navigator wherever he is on the bridge constantly informed as to the handling of the engines and the engineer's



Plant Mills Direction Indicator Demonstrated at Marine Exposition

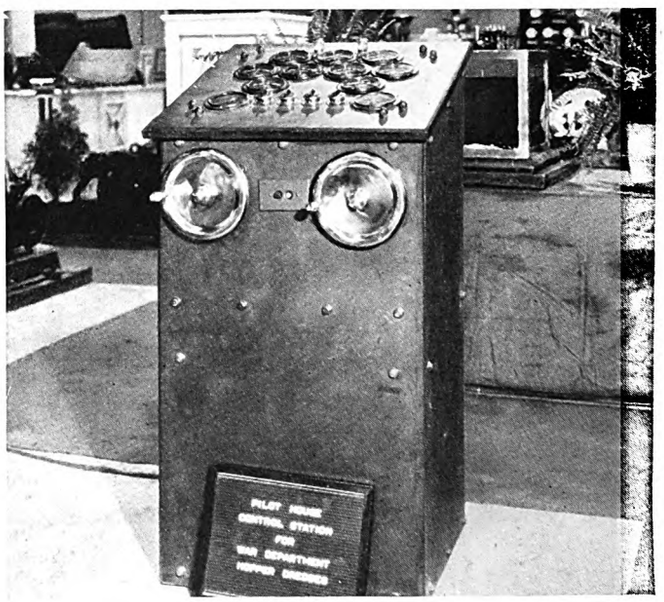
alarm provides a prompt and efficient means whereby the engineer is instantly and automatically warned should he fail to operate the engines in accordance with directions from the bridge.

The bridge indicator, visible from any part of the bridge, shows the speed and direction of the engines; a white light flashes from three upper lenses for every revolution ahead and a red light flashes from three lower lenses for every revolution astern.

By means of flashing red lights and alarm bell in the engine room, the engineer is warned of an error in answering the bridge signals, the alarm operating until the error is rectified. Parallel wiring is used throughout the system.

Control Station for Dredge

THE Westinghouse Electric & Manufacturing Company exhibited the pilot house control station and the corresponding engine room main control panel which will be used for controlling the two 800 horsepower propelling motors on one of the four new 5,000-ton Diesel electric sea-



Pilot House Control for Army Dredge

going hopper dredges now being built for the United States Engineer Department.

By means of two hand wheels on the bridge control pedestal the pilot has complete individual control of the two propelling motors. It is claimed that this is a great advantage on a ship which has to do a great deal of maneuvering. The control pedestal also carries instruments showing propeller revolutions and the load on the motors.

Similar equipment is mounted on the engine room panel, together with a transfer switch by means of which the control may be connected to the bridge station or to the engine room station. The installation is illustrated and described in the "Westinghouse Marine Log" now being distributed in the Westinghouse booth.

Novel Gyrating Electric Ceiling Fan

THE Diehl Manufacturing Company, New York City, is seeking an appropriate name for a novel type of gyrating ceiling fan which was shown at the entrance of booth No. 31 at the Marine Show.

The fan motor was mounted in a ceiling base and supported by ball bearing pivots in such a manner that the motor is free to swing in any direction on the principle of a universal joint. The motor itself also has ball bearings and means are provided to prevent grease or oil from escaping at the lower end. The motor shaft extends downward and carries a 6-blade fan wheel, which may be either 12 inches or

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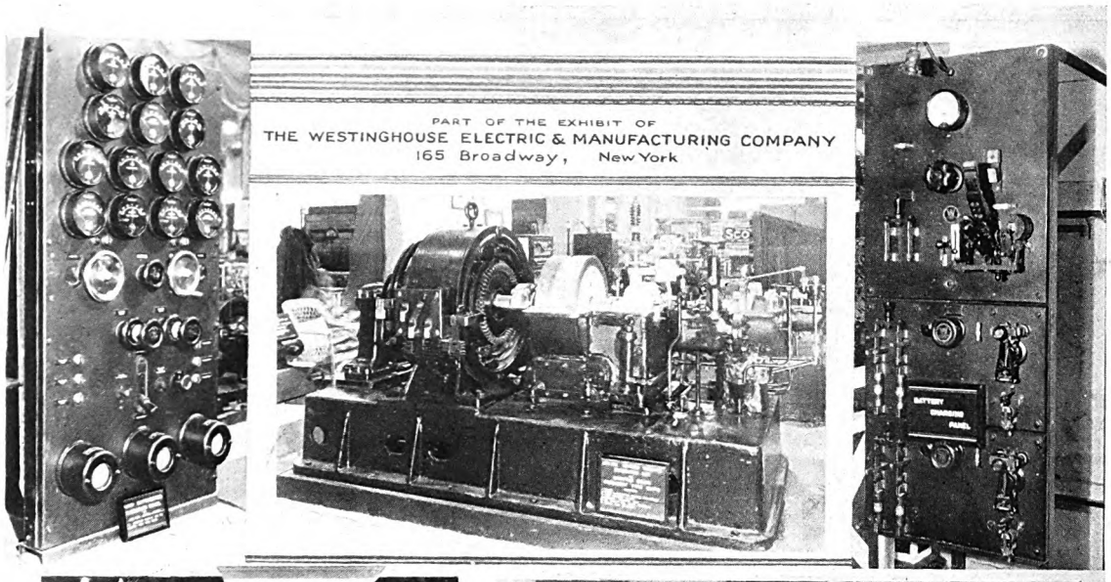
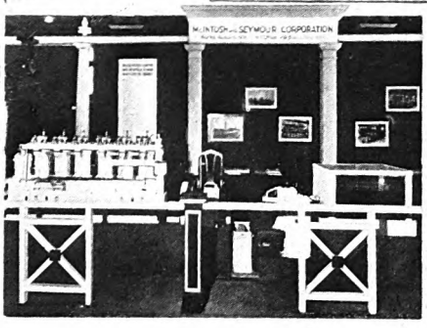
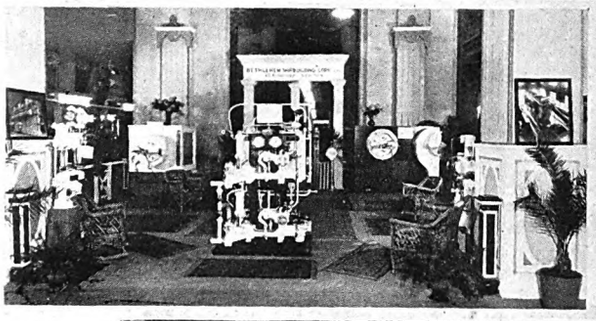
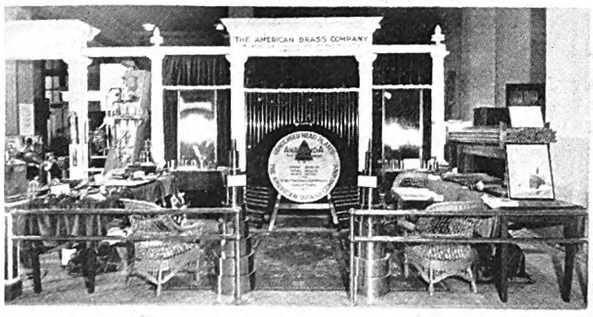
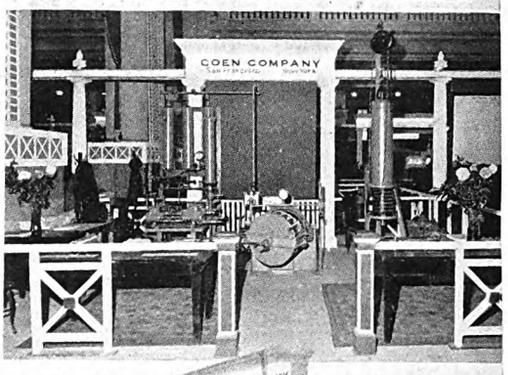


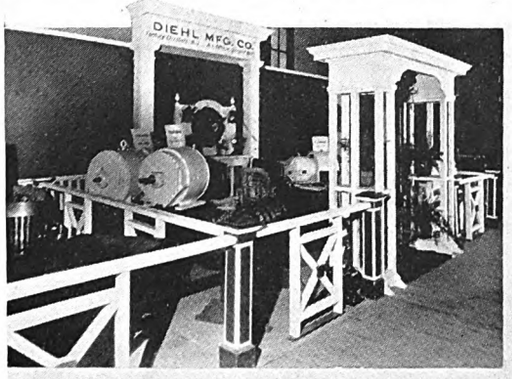
PART OF THE EXHIBIT OF
THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
165 Broadway, New York

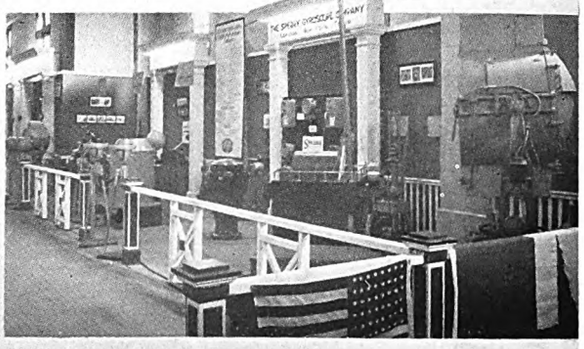












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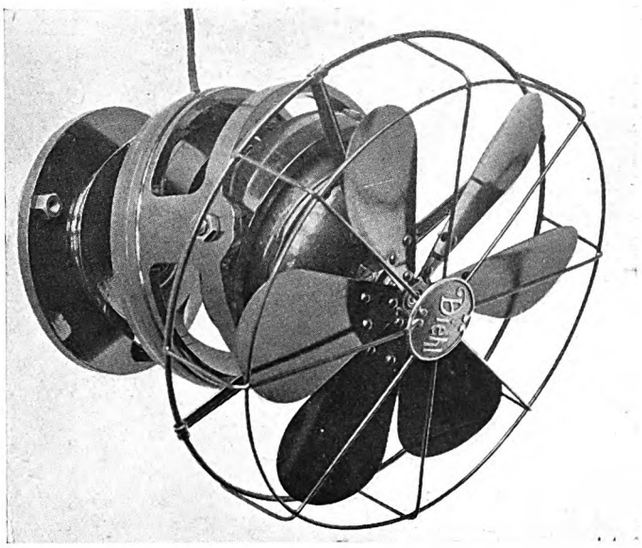
EXHIBITS AT THE MARINE EXPOSITION

16 inches in diameter. The blade is protected by a suitable guard. At the upper end the shaft is connected through a reducing gear to a lever which is attached to the base by a ball and socket joint. The gear reduction is such that when the fan is running at normal speed the lever causes the motor body and fan blades to gyrate at about 6 revolutions per minute. During this gyration the motor shaft always remains at



New Diehl Gyrating Fan

a fixed angle of about 30 degrees to the vertical axis. This angle may be varied to suit local conditions by changing the length of the driving lever at the top.

The fan thus throws a cone of air, with the apex of the cone at the center of the motor. This feature has suggested the names "Aerocone" and "Conovair."

Arc Welder for Ship Work and New Galley Range

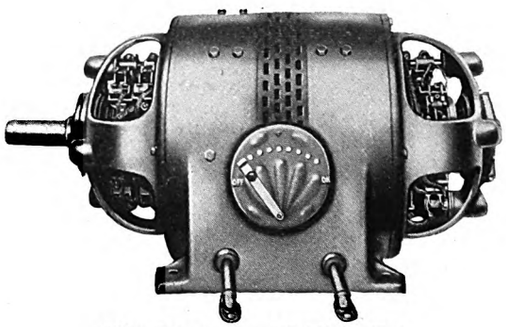
THE Todd Shipyards Corporation in its exhibit showed the Todd twin-pole arc welder which has been developed especially for use on board ship where it comes into service in the repair of leaky seams, fire cracks, leaky pipe joints, worn machinery parts, loose or broken rivets and other essential repairs that can be made by welding.

The Todd welder has been designed for quick work and its small size and weight, it is said, particularly adapt it for ship service. It is 28½ inches in overall length and driven from any plant generating 110 volts direct current or from other similar sources of power supply. It is readily portable and designed for a single operator.

The Todd representatives are calling the welder to the particular attention of shipowners and operators.

New Galley Range

Another feature of the Todd exhibit was a new type oil burning galley range which has been developed to meet the demands of owners for a range that would use inexpensive oils safely and with cleanliness. It is stated that the oil burner part of the equipment is of simple construction and requires little more attention than the burner on the ordinary domestic oil stove. The oil is fed to the burner by gravity, no mechanical aid being necessary for either atomizing the oil or for furnishing air to the burner.

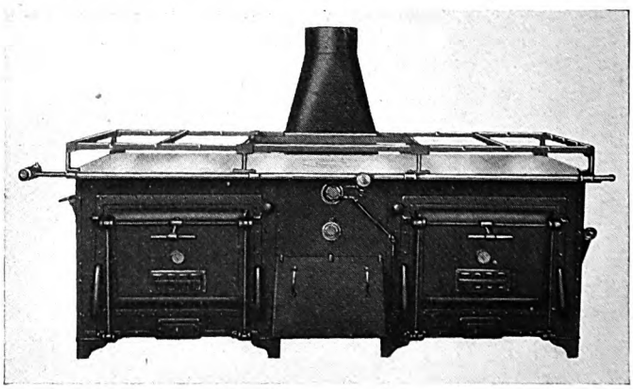


Ship Type Arc Welding Unit

The burner is placed in the center of the range with flues to right and left around the ovens, permitting even regulation of the temperature of the ovens. The oil supply line to the burner on the front of the stove is equipped with a sight feed oil box, in which the flow of oil can be observed.

The range is built of blue annealed mild steel of the highest grade and it is stated will withstand rust, corrosion, hard usage and wear. Castings are of the best grade of gray iron. All exposed sides are insulated with genuine asbestos mill board.

It is fitted with one firebox and two ovens, the range measures 98½ inches in length, 26 inches in depth and



New Oil Burning Galley Range

stands 36 inches high. Its design permits it to be taken apart in five distinct units, handled through a small door and reassembled inside the galley.

The top of the range is made of cast iron, ¾ inch thick on the ends, increasing to a thickness of 1½ inches in the center. Heat will not warp it. The top is polished for use as a grill and is fitted with a gutter completely surrounding the edge of the top to catch the drippings from overflowing.

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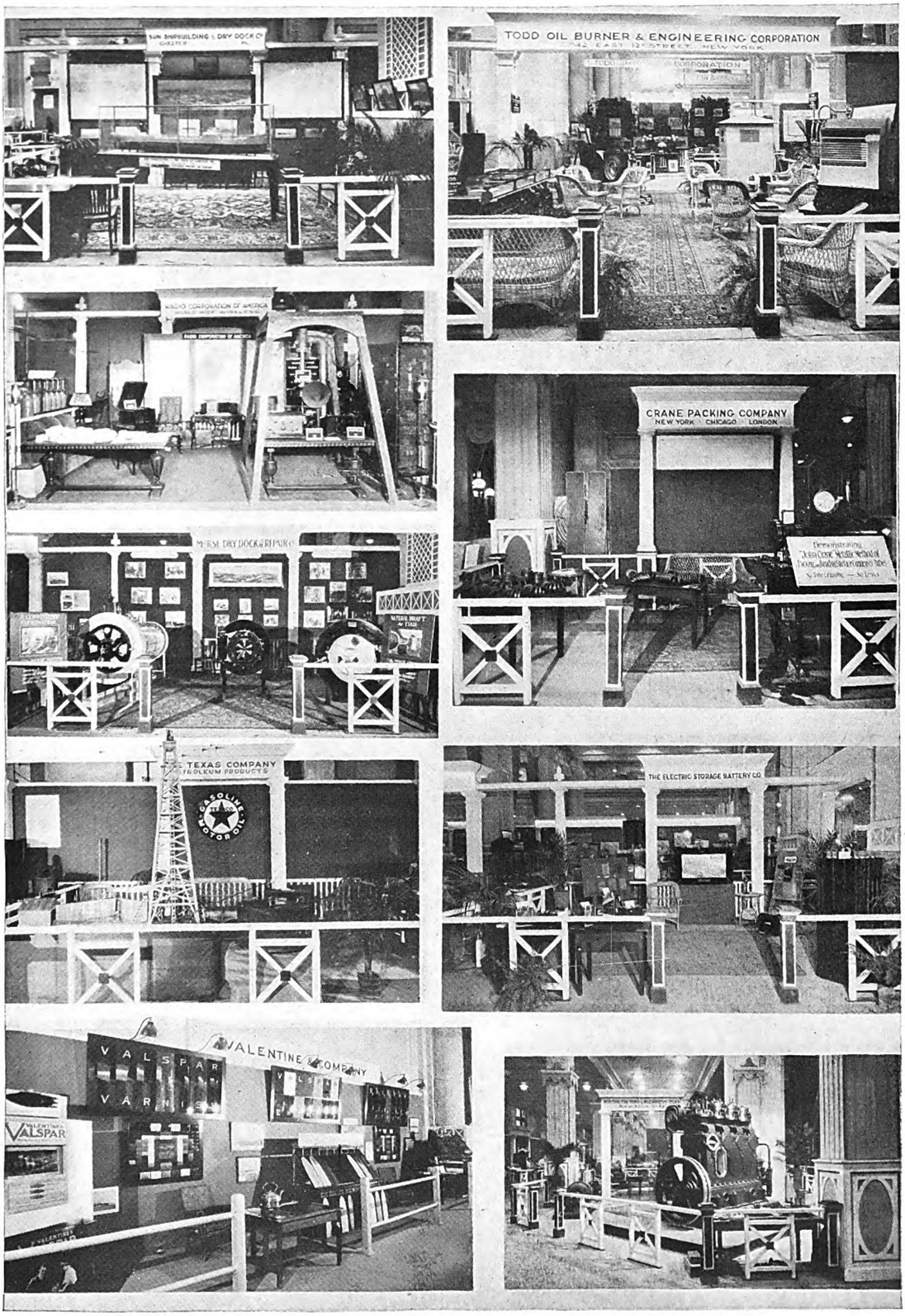

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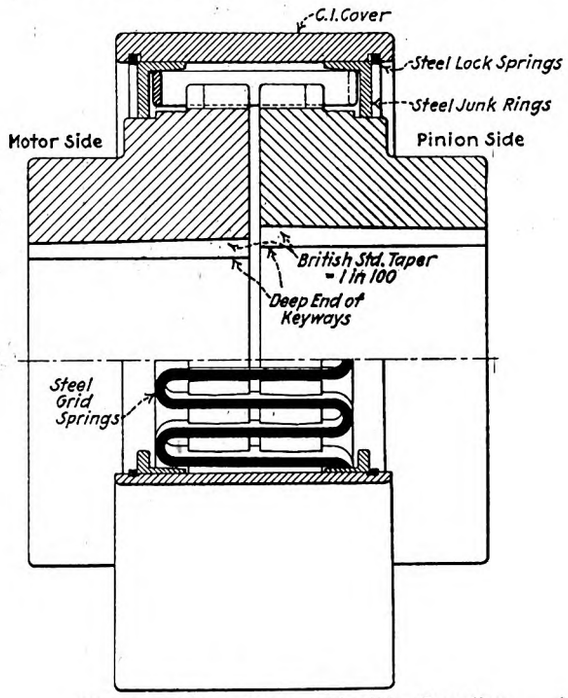
This eliminates danger from fire and makes for cleanliness. Adjustable and interchangeable sea rails are also fitted.

The ovens are of large size, 18 inches by 26 inches by 25 inches, equipped with doors of extra heavy construction, counterbalanced and with protected springs. Door handles are designed to permit the doors being left open one inch for light cooking.

Large flues have been provided around the ovens and a specially designed by-pass damper cuts out the flues, permitting a direct passage from the burner to the stack. This permits the range to be quickly started up.

Bibby Flexible Couplings Manufactured by Falk Corporation

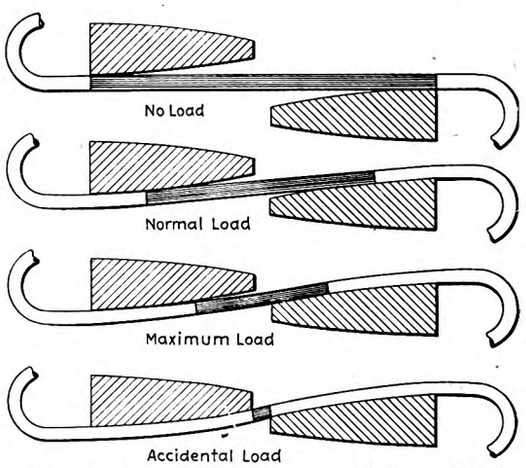
THE Falk Corporation, Milwaukee, Wis., had on exhibit for the first time a flexible coupling invented by James Bibby and manufactured in England by the Wellman-Bibby Company. The Falk Corporation has acquired the exclusive manufacturing rights in the United States of



Sketch of Falk-Bibby Flexible Coupling

the Bibby patents and has equipped its plant with a full line of very ingenious special machinery for manufacturing its couplings to take care of requirements in this country. The coupling will be known as the Falk-Bibby coupling.

This coupling consists of two flanged steel disks (one keyed to each shaft), two or more sequents of a tempered steel spring forming a continuous cylinderical grid, and a steel cover. On the periphery of the flanges are pitched cross grooves in which the spring is placed. The spring is the flexible member and its shape, and that of the grooves, forms the characteristic feature of the coupling. The grooves in the disk widen inward toward each other, so that the spring fits closely in them only at their outer ends. This widening of the grooves is in the form of an arc of definite radius and is produced by machines specially designed for the manufacture of these couplings. The radius of the arc bears a definite relationship to the thickness of the spring bars and is designed so that when each bar is bent around this radius the stress in the spring cannot exceed a fixed safe value. Under light and normal loads, there is a long free span of spring between the points of support on the



Action of Spring Under Variations of Load

two flanges, which allows for considerable flexibility, but under heavy overloads the spring members become supported along the sides of the grooves thereby automatically shortening the span and stiffening the spring.

It is stated that the coupling will compensate for want of alinement of the shafts without setting up cross pulls as occur with belt type couplings. The amount of eccentricity which the coupling will accommodate is more than that caused by worn bearings before they require relining.

The flexibility of the coupling was demonstrated by a remarkable exhibit at the Exposition. A centrifugal pump was mounted on a tank, and driven through a Falk-Bibby coupling by a 5 horsepower motor. This motor was mounted on a plate which in turn was swung sideways so that during the operation of the pump at full load the centerline of the motor shaft was slowly swung sideways up to 10 degrees each way out of alinement with the pump shaft. In spite of this tremendous misalinement the set ran very quietly.

The Falk Corporation claims for the coupling a torsional resiliency which enables it to smooth out bad running conditions.

Improved Sash Balance

THE O. M. Edwards Company, Inc., Syracuse, N. Y., had on exhibition an improved marine sash balance. This device is designed to balance plate glass windows, especially those used on enclosed promenade decks of passenger ships.

The balance is made of bronze to provide against the action of salt water and is mounted away from the deck, so that water will not accumulate around it. It is stated that simplicity and the small number of movable parts add to the efficiency of this device. The entire device is of brass with

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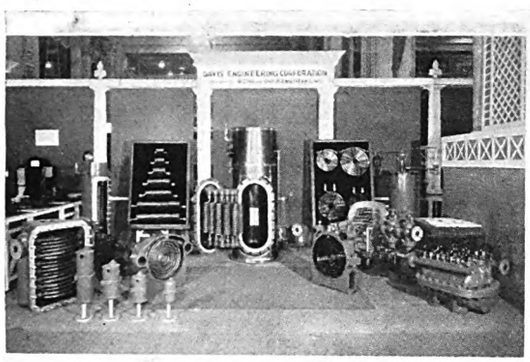

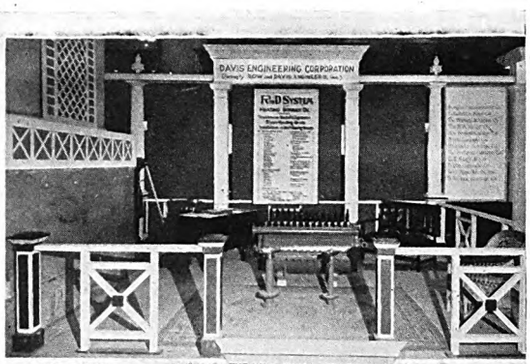

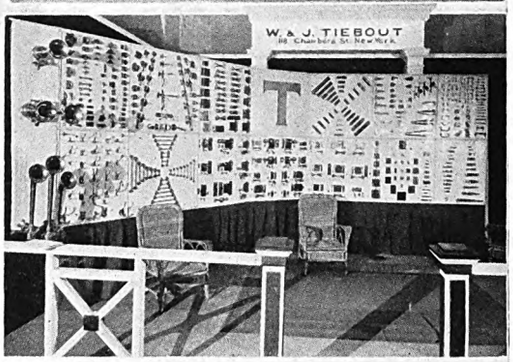

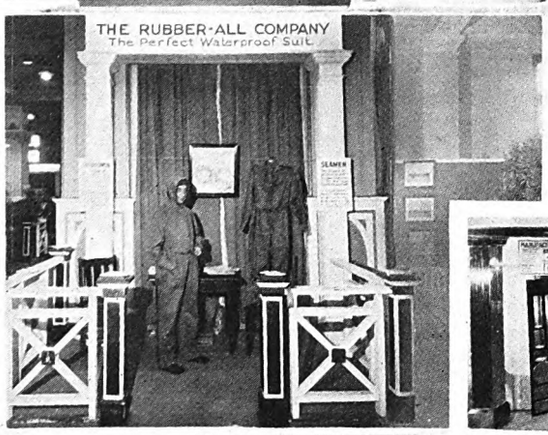

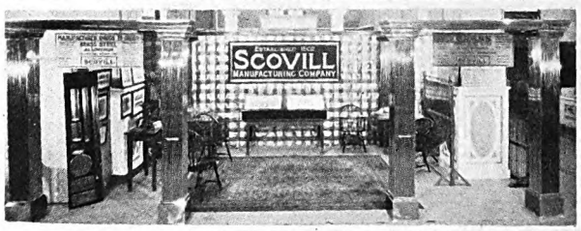

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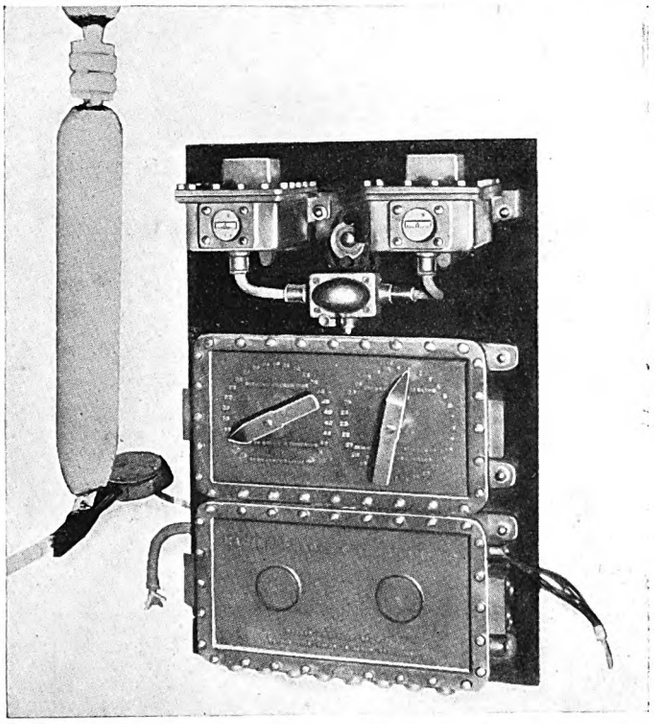
the exception of a steel coiled spring, which provides tension for the balance. This spring is inclosed in a brass cylinder packed with grease.

Tests of the device on the S. S. *President Harding,* under all conditions of weather, have demonstrated its merits.

Temperature Indicator for Cold Storage Compartments

THE marine electric thermometer which has been developed by the Wilson-Maeulen Company, 383 Concord avenue, New York, for many years manufacturers of a high grade of electric thermometers and pyrometers, was demonstrated at the exposition.

This thermometer is an apparatus with which the temperature of a number of stations can be determined within the



Electric Marine Temperature Indicator for Refrigerated Spaces

cold storage range. The apparatus comprises two dials, the one a temperature dial reading from 10 to 60 degrees F. and the other a station selector switch of 30 points. These two dials are mounted on a suitable panel and below them is a junction box. Two galvanometer indicators are mounted above the two dials, one being a spare. A separate waterproof switch is thrown to connect either indicator into the circuit.

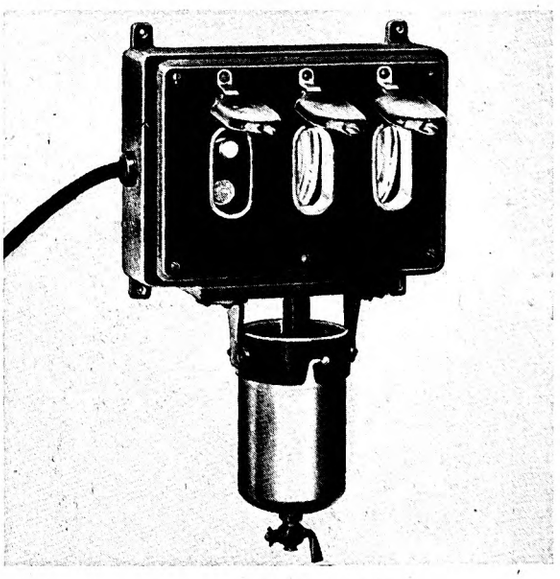
Any number of electric thermometer bulbs (up to 30 maximum) may be located at suitable points where temperature is to be measured. Each thermometer bulb is connected to the indicator panel with a continuous armored cable. The temperature indicating dial and station selector switch mechanism is mounted under the cover in a box casting of marine bronze; operating spindles of Monel metal extending through stuffing tubes to the indicating dials on the front. Connecting wires from the mechanism compartment pass through a stuffing gland at the lower side of the case and enter the upper side of the separate junction box casting where the electric connections are made to the cable from the thermometer bulbs. The galvanometer indicators are fitted in individual marine bronze cases. The scale window is of thick plate glass suitably protected.

These indicators respond to less than one-tenth of one degree F. change in temperature of the thermometer bulb and are necessarily sensitive. The galvanometer indicators are of the moving coil type and are built with only one pivot which is located at the geometric center of the coil and which is also at the center of gravity of the movement. This feature renders the indicator readings practically independent of mechanical vibration and of ship roll.

To operate, turn the station selector switch to the desired temperature point (each point being indicated by a positive click). Turn the temperature dial until the galvanometer indicator index deflects to its zero. The number at which the temperature dial then points, indicates the temperature of that particular bulb.

Salinity Meters

NEW equipment developed by the Brown Instrument Company, Philadelphia, Pa., to detect surface condenser leakage, evaporator priming and boiler water salinity was shown at the Exposition.



Lamp Type Salinity Meter

It is claimed that this salinity detector, which is of the lamp type, eliminates the difficulties experienced with former designs of the lamp type. In this indicator the supply circuit feeds two parallel paths. Two lamps alike in characteristics are used in the circuit as visual indicators in the following manner:

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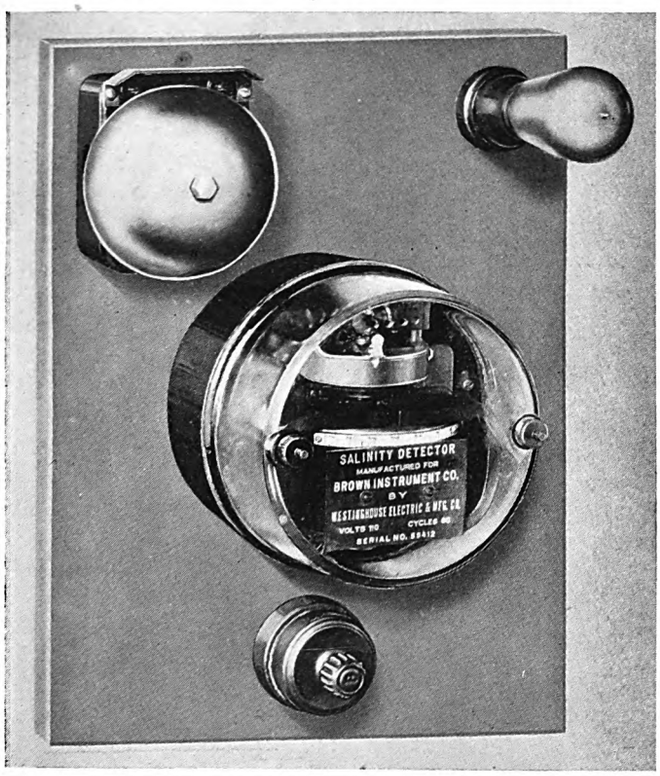
A cell is connected in series with one lamp while the second lamp is connected in series with a variable resistance.

It will be understood that if this resistance is adjusted so as to be equal to the resistance between the cell electrodes for a given concentration of salt in the water, the lamps will burn with equal brilliancy and be affected alike by line voltage. Consequently the observer's eye is provided with a standard for comparison, thus eliminating the personal equation and errors due to voltage variations.

Another feature incorporated in the lamp-meter is the provision for automatic temperature compensation. Temperature



Salinity Detector with Alarm Features

variations, if uncorrected, will produce substantial errors. For instance, if a sample of water at 150 degrees F. is tested with an instrument calibrated at 120 degrees F., an error of approximately 30 percent in the resistance will be introduced. To compensate for these errors the electrodes are so arranged as to move further apart as the temperature increases, thus producing an increase of resistance to balance the decrease due to the rise in temperature.

Induction Type Salinity Indicator

This meter was developed to meet the need for a rugged salinity indicator. The instrument, alarm bell, signal lamp and switch being mounted on a panel. The automatic alarm feature is of great value, in that it will instantly warn the operating engineer if condenser leakage or evaporator priming result in excessive salinity of the boiler feed.

The principle of operation is similar to that of the watt-hour meter. A light aluminum disc, running in jewel bearings, is rotated between laminated magnetic pole pieces by the eddy currents generated in the disc. The torque in one direction is controlled by the current flow through the water surrounding the electrodes. Consequently it depends upon salinity of the water under test. The torque in the other direction is fixed and depends upon the current flow through a resistance. This resistance is so adjusted as to be equivalent to the resistance between electrodes at a definite salinity. Then, if the salinity of the water under test exceeds this predetermined value the disc will rotate and close a contact in the alarm or signal light circuit. If the salinity should be lower than the predetermined value the torque controlled by the fixed resistance will predominate and the meter disc will rotate in the opposite direction.

Automatic temperature compensation is secured by varying the resistance in response to temperature changes. The instrument, it is claimed, is practically free from voltage and frequency errors in that the circuit is differential and essentially equivalent to that of the Wheatstone Bridge. Vibration has very little effect on the meter because of the absence of fragile suspensions. The moderate accuracy, ruggedness and low cost make this instrument particularly suitable for marine service. Its construction renders it practically moistureproof. The compact form is also of advantage for installations under conditions where very little space is available. Alternating current is necessary for operation of this meter.

Combined Fire Detecting and Extinguishing System

A COMPLETE installation of the combined Lux-Rich System for detecting and extinguishing marine fires as it will be fitted on the motorships *Challenger* and *William Penn* was shown at the booth of Walter Kidde and Company, New York City, distributors for the system.

Another feature of the exhibit of this company this year was an electro-vapor radiator the American rights for which are controlled by the Walter Kidde and Company. The staterooms of the new Southern Pacific passenger ship being built at the Tacoma, Washington, yard of the Todd Shipyards Corporation will be fitted with these radiators.

New Developments in Fire Detecting Wire

A NEW feature in the exhibit of the Fire Detecting Wire Corporation, New York City, was their waterproof thermostatic wire. This company's wire was first developed for shore use, and the outer insulation was made of varnished cambric. Although this wire was moisture-resisting to a degree, it was not entirely suited to the severe conditions encountered at sea.

For this reason a waterproof wire was developed which it is claimed has successfully met the rigorous conditions of marine service.

A wall of uncured rubber was substituted for the varnished cambric. Tests made daily on samples submerged in salt water for long periods show this wire to be unaffected in any way.

An installation of 6,000 feet made in a ship last April is giving entire satisfaction.

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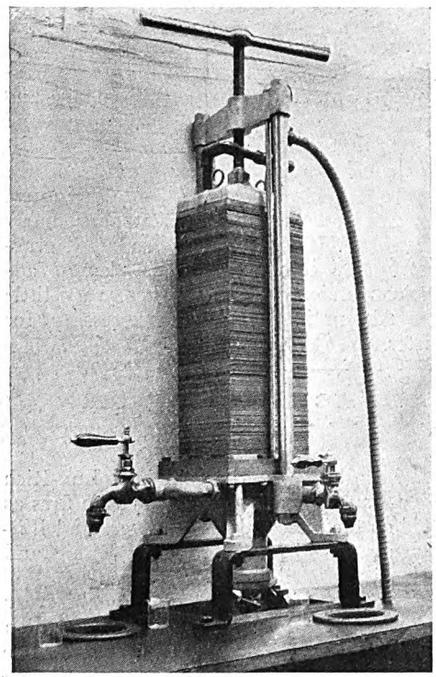
Stream-Line Filters

ONE of the most interesting exhibits at the Shipping Exhibition recently held at Olympia, London, was the stream-line filter. This remarkable apparatus has attracted widespread attention in Great Britain and a company, known as the Streamline Filter Corporation, has recently been formed in New York with Mr. F. D. Herbert as president for its production in this country.

The stream-line filter is the invention of Dr. H. S. Hele-Shaw, the eminent British scientist and was described by him in a paper read at a meeting of the London Section of the Society of Chemical Industry in June, 1923, as follows:

In a paper presented recently to the Royal Society the author explained that he had in the course of certain experiments with thin films found that not only was it possible to separate the very finest matter in suspension from a fluid, but even apparently to separate two fluids of different densities if the film were sufficiently attenuated. For the purpose of doing this he employed a fibrous or textile material impervious to the action of the fluid itself. The material employed was a form of waterproof paper.

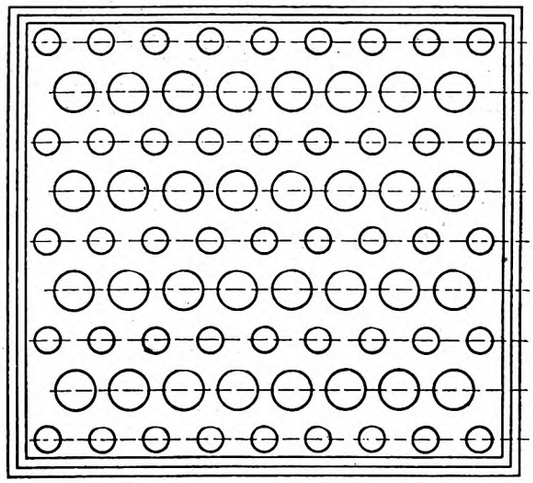


Single Unit, Vertical Type Stream-Line Filter

It is important to show how it is that the stream-line filter of comparatively small size is able to deal with large quantities of fluid at moderate cost.

The essential points of the stream-line filter are the employment of one or more packs of impervious material, preferably paper, on account of its lightness and cheapness, the pack being held between two ends called pressheads; also means of controlling the pressure according to the filtration required. With the view to economy the sheets in the pack are cut rectangular in form, and with a view of getting as large a filter surface as possible for what may be known as edge filtration as opposed to surface filtration, each sheet is perforated with an identical number of holes in such a way that the holes lie in alternate rows of large and small holes. When the sheets are put together in a pack (as in the case of the filter shown to the meeting, 4,000 or 5,000 sheets) the holes form tubes. If into one row of tubes the prefilt, or liquid to be filtered, is forced under pressure from the pressure head and the opposite ends of the tubes remain closed, there is no escape for the liquid except through the interstices of the sheets. The liquid passes through these interstices, leaving behind the matter in suspension in what may be called the inlet tubes, and passes down the smaller or outlet tubes. In the language of hydrodynamics, each large inlet hole in the sheet thus becomes a "source," and each outlet or smaller hole becomes a "sink." It is obvious that the area of filtration is represented by the area of the inner surface of the larger cylindrical tubes, which is why these tubes are made larger. The smaller tubes are quite sufficient to discharge the filtrate.

By degrees a film is formed on the inner surface of the larger tubes, consisting of particles which are unable to pass between the sheets, and are thus filtered out from the general



Arrangement of Perforations in Sheets of Stream-Line Filter

body of the liquid to be filtered. Now there are obviously two important functions of the filter, one being that in which the object is to recover the liquid which has passed through the sheets in a purified condition, as, for instance, the case of filtration of water or oil, the suspended matter being dirt or impurity of some kind which has to be removed; in the majority of such cases removal of the impurity or dirt can be effected by opening up the larger tubes and washing through with the prefiltrate or fluid to be filtered. The other case is much more difficult, being that in which the solid matter left behind, or residuum or "depot," which may be solid or a viscous fluid, is the valuable material of which recovery is sought. In this case the washing out is never easy to effect, and is very often impossible, or at any rate impracticable. One mode of removing the material is by rods, in which case the

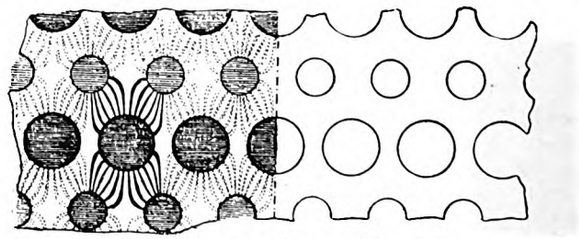


Diagram Showing Stream-Line Flow

filter is generally required to be opened. Other methods are under consideration and trial, but the object to be aimed at is undoubtedly to effect clearance of the solid matter in the way that the washable dirt is at present collected—namely, without opening up the filter, and if possible without employing such mechanical devices as involve the use of bevel wheels or spiral drums, actuated by external machinery, and requiring packing glands in the filter itself.

By putting a large number of packs together in rows, it is quite easy to see that as the operation of washing out the inlet tubes is a matter of, at most, a few seconds, it is possible to have continuous action, and only one pack at a time need be put out of action for washing. Suppose, for example,

(*Continued on page* 770)

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Naval Architects' Meeting a Feature of Marine Week

Society of Naval Architects and Marine Engineers Discusses Economic and Practical Phases of Merchant Ship Construction and Operation

THE thirty-first general meeting of the Society of Naval Architects and Marine Engineers was held at the Engineering Societies Building, 29 West 39th street, New York City, on November 8 and 9, with President W. M. McFarland in the chair. Immediately following the opening of the meeting the secretary read the annual report. He commented at some length upon the loss in membership that had taken place after the peak membership attained during the war, but said that the gain in the past year had been quite as much as was expected and that a considerable part of the loss during that same period was due to elimination of members for non-payment of dues which had been too long delayed. The growth of the endowment funds was in good condition and steadily increasing.

Abstract of President's Address

There is an aspect of this period of depression on the side of personnel which is very serious and filled with danger to the profession. The dull times have thrown many highly experienced men out of employment and they have been forced to take up other lines. This is also true to some extent with consulting naval architects and engineers.

First National Marine Congress

At this time, in this city, there is in session the first National Marine Congress, in which our Society is represented and which is an effort to bring together all who are interested in the prosperity of the American Merchant Marine. The interests represented are not only ship owners and operators and ship and machinery builders, but exporters, manufacturers in general and the farmers. Thus it appears that an earnest effort has been made to bring together representatives of our whole people in the hope that by conference and discussion some scheme can be evolved which will meet with general approval and can be presented to Congress as representing the wishes of the nation.

Vessels for Coastwise Service

What I have said with respect to the terrible depression in shipbuilding applies particularly to vessels for foreign trade. There is, however, a silver lining to the cloud when we think of vessels for the coastwise service and for our bays, lakes and rivers. For this service 36 vessels of 143,669 gross tons have been built in American yards from January 1 to November 1, 1923.

Orders have been placed for a number of large vessels on the Lakes. The Southern Pacific Company has recently placed an order for a large, thoroughly modern passenger and freight steamer for their line from New York to New Orleans, and two Eastern coastwise companies have placed orders for two vessels each which will be thoroughly modern in every way. It is also stated on good authority that a prominent shipping company on the Pacific Coast is about to place the order for a large, high speed passenger and freight steamer for service to the Hawaiian Islands. Other projects are under consideration and may materialize very shortly. All of these will mean work for our shipyards and give an encouraging aspect to prospects for shipbuilding.

With respect to the general survey of marine conditions, for large power houses on shore the tendency seems to be a very material increase in steam pressure and in the amount of superheat carried, so that there are a number of installations carrying 350 pounds pressure, a few that have gone as high as 600 pounds, and a few small plants have been built for 1,200 pounds pressure to see what trouble will develop. The demand for economy in the production of power is so great that these large installations are neglecting no detail which will contribute to that end. It seems probable, if the experience with these higher pressures on land is satisfactory, that it will have an influence on the design of machinery for vessels, and undoubtedly our leading designers are studying this movement very carefully so as to be prepared at the proper time to bring out designs which will represent the latest steps in progress.

Election of Officers

The following officers whose terms expired December 31, 1923, were re-elected:

Vice-Presidents: Homer L. Ferguson, Frank L. DuBosque, Henry A. Magoun, William A. Dobson.

Council Members: (Representing Members of the Society): Herbert C. Sadler, William H. Todd, Daniel H. Cox, Ernest H. Rigg, Charles F. Bailey, William McEntee. (Representing Associates): Herbert L. Aldrich, W. L. Marvin, M. D. Ferris.

Executive Committee: Walter M. McFarland, ex-officio; Stevenson Taylor, Frank L. DuBosque, Washington L. Capps, Joseph W. Powell, Andrew Fletcher, Homer L. Ferguson, Daniel H. Cox, ex-officio, Alfred Gilbert Smith.

Secretary-Treasurer: Daniel H. Cox. Assistant Secretary-Treasurer, Thomas J. Kain.

Additional Notes on American Shipyard Apprenticeships, Evening Schools and Scholarships

By Chas. F. Bailey

Abstract

The advancement in shipyard apprentice work and evening schools during the last two years, while considerable, is apparently not as great as the progress in some of our large manufacturing corporations. This condition is to be regretted, but it is largely explained by the fact that during this period we have been, and still are, struggling for the very existence of the shipbuilding art, principally owing to the cessation of naval construction and to the small amount of new merchant tonnage now building. Due to the above considerations some yards have made but slight advancement, while others have even reduced their apprentice training or almost entirely done away with it.

With the Newport News Shipbuilding and Dry Dock Company interest in apprentice training has increased during the last three years or more, and it is now greater than at any previous time. The character of the boys and their attitude and bearing have uniformly improved during the last three years. The establishment of scholarships has also tended to raise the character of the apprentice applicants, and they now come with a better preparation than previously.

The scholarships offered are as follows:

(*b*) A two-year course covering work in a number of the following subjects: Language, Mathematics, Physics, Chemistry, Metallurgy, Electricity, Marine Engineering, Naval Architecture or allied subjects in an approved university, technical school or institute.

(*c*) A one-year course covering similar work in several of the above subjects in an approved university, technical school or institute.

(*d*) A home correspondence school course in an approved

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correspondence school or a course of thirty-six weeks in the Industrial Y. M. C. A. Evening Preparatory School of the city.

Candidates for scholarships are required to be American citizens and not less than seventeen nor more than twenty-one years of age. Appointments are based upon general conduct, workmanship, character and ability. Scholarships (*b*) and (*c*) are granted only to apprentices who have served approximately two years of their time. Scholarship (*d*) may be awarded after one year of apprenticeship.

The expenses of these scholarships are borne by the company; these expenses include fees, tuition, subsistence, books, instruments and an allowance for traveling expenses. The apprentice is required to serve in the works of the company during vacations, for which services the regular rates of pay for apprentices are in effect.

The granting of scholarships to the apprentices has not created discontent among the boys who are not thus recognized, but, on the other hand, it has had the effect to stimulate them in their efforts. Applications are numerous in a number of the trades, particularly in the electrical and machinist departments, in which there are more applications than can be accepted.

It is not a difficult thing to show an ordinary boy of ambition who is undertaking a trade that it is very honorable and creditable to become an expert mechanic in his chosen line. Such mechanics are comparatively rare, and a boy can feel great pride in knowing that his skill is such as to win commendation and single him out as of note.

Apprenticeship in foundry work has not been very popular, but an endeavor is now being made to show the excellent opportunity which this offers.

The apprentice school work is so adapted and arranged as to assist the boy in shop work, especially in drawing, mathematics, physics and chemistry. This school work is required of each boy, beginning immediately after his six months of probation and continuing for three years, excepting for the summer vacations. Each boy is required to attend two sessions of three hours each, weekly. The time spent in this school work counts on his apprenticeship and is paid for at the regular apprentice rate to which he is entitled.

The correspondence scholarships are especially adapted to young apprentices, as they entail night study, which is no hardship for a boy working eight hours physically, or only five hours during the days on which his school session comes.

The interest of the boys in shop work and school work at the yard is such that, when necessarily left to carry on in the absence of the instructor, they do this without disorder or lack of application. The apprentices have adopted a Constitution of Apprentice Government for the purpose of promoting a helpful feeling toward each other, an apprentice spirit, the business interests of the apprentices and the attainment of greater opportunities for future apprentices of the company. The working body of this organization is the Apprentice Council, composed of ten active representatives elected from departments or groups of departments in the yard. An honor system has been adopted by the apprentice body. This is an innovation among the apprentices, but it promises to function admirably.

Evening schools are conducted under the educational director of the Young Men's Christian Association. An Educational Committee composed of influential men of the town and officials of the yard meet monthly to advise and assist in the work.

An Apprentice Athletic Association, with annual dues of five dollars, handles the athletic activities of the boys. The dues are budgeted to the various sports. The supervisor and his assistants handle the receipts and disbursements. Championship teams in basketball, baseball and football are arranged. During this season the football schedule calls for games with high schools, colleges and with one college varsity team. No games other than with school teams are scheduled. Stress is laid on clean sportsmanship which is recognized by the various schools with which games have been played.

A band of several pieces has been organized and a glee club has been formed. A bulletin is issued each week to which the apprentices contribute news items of events of interest.

We believe that the organizing of apprenticeships in trades, with scholarships and night schools, can be successfully handled by any yard and become a paying investment in addition to training up young men of character, who will become useful, contented, influential, service-giving citizens; but this means that the owner, a responsible part of the management and many others in the organization must take a heartfelt interest in the young men. It cannot otherwise be done successfully.

DISCUSSION

This paper was discussed at some length by President McFarland, by Hugo P. Frear, whose discussion of the paper was read by Captain Linnard, by Professor Sadler and by Homer L. Ferguson, president of the Newport News Shiping and Dry Dock Company. Mr. Ferguson made mention of the great improvements, in his opinion, of training the apprentice in athletics as an adjunct to their shop training and as being one of the most important parts of the whole system.

W. M. MCFARLAND, president of the Society: I have read Mr. Bailey's paper with a great deal of interest and pleasure. It is the kind of paper that I believe will be productive of great good and he deserves our thanks for presenting us with such valuable information. I am very much struck with the incentive offered to the boys by the provision for courses in technical schools and elsewhere at the expense of the company. I regard this feature of the plan, as outlined by Mr. Bailey, as of the utmost importance. I am also greatly pleased to notice the stress he lays on the honorable and creditable standing of the highly skilled mechanic. The paper is so full of good points that to comment on everyone of them would almost amount to writing another paper, and I will refrain from further remarks except to state again what a pleasure it has been to read the paper and my desire that Mr. Bailey should understand our thorough appreciation.

HUGO P. FREAR, naval architect, Bethlehem Shipbuilding Corporation, Ltd.: There is no one connected with shipyard operation who does not appreciate how valuable an asset the right kind of apprentices are. It cannot be disputed that they have a direct and positive influence in lowering the cost of production besides providing man capital to draw on in the future.

Comments on Aviation—Naval and Commercial

By Captain E. S. Land (C.C.), U. S. N.

ABSTRACT

Naval aviation has been aptly termed "the eyes of the fleet." It is needless to add that any arm of any service is very severely handicapped, if not entirely incapacitated, when it does not have proper eyes to carry on its maneuvers, be they peaceful or militant.

Since the armistice there has been a relatively great change in naval aeronautics. During the war every effort was made to produce aircraft for countersubmarine work and for convoy and patrol duty. This led to the development of large flying boats and non-rigid airships. These types now exist in a fairly satisfactory state of perfection, and attention has been diverted from them to the development of aircraft suitable

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for use with the fleet. Fleet aviation requires small and handy combat planes of high performance to be carried with the fleet; planes for scouting, observation, and spotting gunfire; and torpedo and bombing planes for offensive use against an enemy fleet. The development of these types has been pushed vigorously, and there are actually in existence and in operation today a number of designs which give great promise of fulfilling the needs of the fleet.

Simultaneously with the development of special aircraft for fleet work, the problem of carrying these planes with the fleet has received consideration. In home waters, large flying boats working from harbors and bases on shore have proved serviceable, but in order to carry planes with the fleet, it is necessary either to carry the planes on regular ships of the fleet or on special aircraft carriers. This requires that fleet aircraft be small and compact. It has not only been proven possible but also entirely practicable to launch planes by means of catapults; but it is not yet practicable to provide sufficient deck space for planes to return again to the regular ships of the fleet. This requires that these planes must either be designed as seaplanes to alight on the water or they must alight on the flush deck of an airplane carrier.

Successful efforts have been made during the year to develop a suitable fighting plane for the fleet which is small enough to be handled by ships.

As to spotting and observation planes, experience in the battle and scouting fleets has furnished sufficient information to proceed with the construction and delivery of several types which should fulfill the requirements of the fleet.

The development of a suitable torpedo plane has proven extremely difficult in view of the necessity for obtaining a small and compact plane which will, nevertheless, carry the standard torpedo. Five different types of experimental torpedo planes have been constructed, and several of these types have been tested out not only by the Navy Trial Board but also by the service.

The Bureau of Aeronautics has followed the policy of encouraging design and invention outside the Naval Service, but has taken great care to maintain a sufficiently expert design staff so that the Navy would never be entirely dependent upon or forced to accept only such designs as might be submitted by contractors. In the same way, while the procurement of aircraft is normally handled by contract after competitive bidding, the war showed the necessity for controlling the production of a portion of the Navy's requirements for aircraft and the Naval Aircraft Factory was created and has been maintained in an active, but much reduced, operating status.

So far as the lighter-than-air activities are concerned, we are now on the threshold of development, tests, and trials which will indicate, not only to the United States Navy but to the world, whether or not lighter-than-air in general and rigid airships in particular have a proper place in the naval organization. Not only are the military eyes of the world concentrated on these activities, but also the commercial eyes; assuming that the results obtained by the United States Navy in connection with rigid airships are successful, there is no doubt but there will be a tremendous impetus, both from a military and from a civil point of view, in connection with the development and construction of rigid airships throughout a number of countries in Europe and probably in Japan. There is no denying the vulnerability of this type of war weapon, but at the same time it is practicable to make these ships less vulnerable than they have been heretofore.

The rigid airship operating alone might readily be compared to a battleship operating without a convoy of destroyers. The rigid airship in action would probably be convoyed by combat planes or other types of planes, depending upon the mission to be fulfilled. The great advantages of rigid airships from a military point of view are: Their great radius of action, their high speed, their ability to hover, their ability to readily obtain great altitude, their ability to receive and transmit information, and their general long-range scouting ability, particularly with regard to coastal patrol. It is believed that they form the means par excellence of antisubmarine patrol. They probably will be the aircraft carriers of the future.

At the present time, a new standard of service acceptability has been set up—a standard which requires that each type of engine demonstrate its ability to withstand a running test of 300 hours at full throttle without any failure of such nature as would force a termination of any flight under service conditions. The work accomplished and the work under way in connection with this matter is of the utmost importance to the aerial strength of the Navy, since it goes far toward eliminating the greatest single source of weakness in our aircraft operation—that is, the delays, the uncertainties, the hazards, and the expense occasioned by power plant failures.

In order to satisfactorily "sell" aviation to the Navy, it is essential that aircraft power plants be made reliable and dependable. To an extent not paralleled in any other form of transportation, the performance and utility of aircraft are measured by the degree of excellence of the power plants available, because the power plant not only propels, but also, in the case of airplanes, is the sole means of support.

"Selling" aviation to the country will be a very simple proposition as soon as it can be reasonably shown that aviation does not involve undue risk of life and property. It is a matter of interest to note in this connection that records collected in England indicate that the greatest percentage of passengers, by nationality, who use commercial aircraft flying to and from London is American.

The greatest crying need of commercial aviation at the present time is satisfactory legislation on the statutes of the Government which would control the rules of the air, the inspection, construction, and operation of aircraft, and instruction of aircraft personnel. Commercial aviation since the end of the war has had very difficult sledding financially. There is a nucleus of commercial aviation in existence in this country which deserves the earnest support of the country. As a nation, we have always been strong to protect infant industries, and certainly there is no better way to apply this protection than to lend financial assistance to commercial aviation throughout the United States.

DISCUSSION

PROFESSOR WILLIAM HOVGAARD, of the Massachusetts Institute of Technology: Captain Land's paper has the rare merit of giving a sober and objective description of the present status of naval aircraft and affords a good basis for judging of the capabilities of this new weapon. In spite of the conservative tone of the paper—or perhaps just because of that—one is impressed with the great possibilities of aircraft in naval warfare. In order to form an opinion of the strategic value of aircrafts, it is necessary to consider primarily long continued war service under ordinary service conditions and, in doing so, we must on the one hand reckon with an average performance of aircraft far below the optimum but, on the other hand, we are justified in assuming that airplanes will be present in future wars in vastly greater number than at present, according to the resources of the respective countries.

(1) *Limitation of Airplanes.* As pointed out by Captain Land, the power plant is yet far from reliable. Planes are very dependent on weather conditions. They are fragile and vulnerable and navigation is often difficult and uncertain. In actual war service, and considering all conditions of wind and weather, the airplane is on the average a short range and uncertain weapon as compared with destroyers and submarines.

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(2) *Coastal Service.* In coast defense it is probably safe to reckon on an effective range of airplane up to about 100 miles from shore more or less according to circumstances. If a belt or lane of some 50 to 100 miles can be kept under actual surveillance of planes at all times, it will permit the coastwise trade to be carried on in relative safety and will render a close blockage practically impossible. Landing of troops in force on an enemy coast can only be carried out with any prospect of success, if it is possible to establish command of the air at the point of landing.

(3) *Operation in Narrow Seas.* The passage through straits, such as those at the entrance to the Baltic and the Black seas, will be rendered dangerous in the presence of an active enemy bordering on the coasts of such waters. It is conceivable that under certain war conditions England may be forced to direct the main traffic to India via the Cape route.

(4) *Naval Stations.* The safety of naval stations may be strongly affected, favorably or unfavorably, according to their location. Detached naval stations, such as Pearl Harbor, the Canal Zone, Aden and Singapore, distant from any possible enemy base, will gain in defensive strength, if they are well equipped with airplanes, while, on the other hand, a station situated as Malta may, under certain war conditions, become entirely unsafe as a port of refuge.

(5) *Service of Airplanes on the Ocean.* Airplanes, due to their short effective radius, cannot operate independently over the sea except in close vicinity to the coast where they have their base. In order to operate over the wide expanse of the ocean they must be carried by and based on ships. Such carriers cannot by themselves secure permanent control of the ocean or any part of it.

(6) *Conclusions.* Airplanes in the present stage of development appear to have their greatest value as a means of coastal defense, although in actions between ships they may achieve great results when used offensively. The advent of aircraft is of special benefit to the United States since this country, with a well-developed coastal air defense and a strong navy, can be made practically impregnable. It is of particular importance in the defense of Hawaii and the Canal Zone. Aircraft may also be of great benefit to the British Empire in the defense of its vast and scattered parts. As regards England herself, the insular position is an advantage in defensive warfare but the immunity from attack which could formerly be obtained by supremacy at sea is lost forever.

MASON S. CHASE, naval architect, spoke most interestingly on the commercial importance of aviation. Mr. Chase also made reference to the very vital matter of the effect of aviation upon the morale of the crews of naval vessels. Captain Westervelt and Admiral Taylor also discussed the paper and gave interesting sidelights upon it from the naval point of view.

Some Factors Affecting the Economy of Operation of the Lake Freighters

By Professor Anders Lindblad

This paper is published on page 764 of this issue.

DISCUSSION

HUGO P. FREAR: It has been recognized for many years that the bulk-cargo traffic on the Great Lakes is in a class by itself. In no other restricted territory are such vast tonnages moved. Transportation on the Great Lakes is cheaper than in any other part of the world in spite of the short season and limitation in draft. A fact that is brought out most convincingly is that each size of vessel has a certain speed which will produce the greatest return from the investment for various freight rates and coal prices.

W. W. SMITH, chief engineer, Federal Shipbuilding Company: The author's conclusion, that steam turbine and Diesel installations are not practicable in Great Lake vessels does not seem to be well founded. A properly-designed turbine installation for the larger powers should cost less and have a less fuel consumption than reciprocating engines. It would seem that turbines should not be dismissed entirely without further consideration. I also think it would be unwise to put aside the oil engine as unworthy of further consideration. It is true that many current designs of oil engines are very heavy and expensive but the oil engine is developing rapidly and the engine of the future may be very different from that of today.

REAR ADMIRAL D. W. TAYLOR, former chief constructor of the United States Navy: The paper brings out in a remarkable way the influence of the cost of power upon profits. The cost of coal is beyond the control of the naval architect but evidently the speed to be obtained and the power required to obtain it, both more or less controllable features, are important factors in the equation.

Lake freighters as they stand are handicapped in several ways with respect to speed as compared with ocean-going craft. With limitation to shallow draft, their lengths are excessive. Owing to the great lengths and low speeds of lake freighters, their speed-length ratios are very small indeed, but, in spite of their abnormal frictional powers, their residuary resistance—mainly wave making, seems rather high. The block coefficients of these vessels are very high as compared with those of sea-going craft, but this does not mean much for parallel middle body vessels of great length.

It seems that it is these slow full vessels that need most and repay best thorough experimental investigation of propulsive efficiency.

So far as I know, self-propelled model investigations for these vessels have not yet been made. A very modest expenditure for this purpose would, I am convinced, result in a further material reduction in the astonishingly cheap cost of transportation of bulk cargoes on the Great Lakes.

President McFarland also expressed appreciation of this paper as dealing with the commercial side of engineering as differentiated from the purely scientific or engineering side.

A. E. F. Robertson of the Munson Steamship Company and finally Professor Sadler also made remarks relative to the various lines of thought suggested by the paper and dwelling upon its value as a contribution to the literature of the subject treated.

Wetted Surface

By Henry H. Schulze

This paper will be published in a later issue. As published articles on the subject of wetted surface are generally an attempt to devise a fairly capable method to cover all types of vessels with the attending result that the accuracy on particular types of vessels is thereby impaired, this paper embodies a complete investigation of the subject for one particular type of vessel—a merchant cargo ship of comparatively full form.

DISCUSSION

REAR ADMIRAL D. W. TAYLOR, U. S. N.: As an ancient worker on the matter of wetted surface I want to bear testimony to the value of this paper and the great amount of work required to obtain the results of which Mr. Schulze has given us the benefit. I recall none published on wetted surface comparable with it. Accurate calculations of wetted surface are laborious and monotonous and those of us who deal with them should be grateful to the author for lightening our labors.

Professor Sadler also complimented the author on his work.

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Propeller Design Based Upon Model Experiments

By Rear Admiral D. W. Taylor (C.C.), U. S. N. (Retired)

ABSTRACT

It need hardly be said that when we utilize the results of model experiments in the design of full-sized propellers we rely primarily upon Froude's Law of Comparison, which is now generally accepted by naval architects and marine engineers. Fortunately, in dealing with propellers we find that for a given slip ratio kept constant as speed and revolutions increase, the torque and thrust both increase substantially as the square of the speed or of the revolutions, efficiency remaining unchanged. We may call this for convenience the Law of the Square. If as we increase speed with constant slip the motion of the water relative to the propeller remains the same, we know that the Law of the Square must always apply exactly. It seems hardly likely, however, that this relative motion will remain exactly the same for all speeds. In stream-line motion pressures caused by the motion of an object through the fluid vary as the square of the speed, and the velocities resulting from these pressures as the speed. But the question whether in water, where stream lines are not perfect the Law of the Square is followed sufficiently closely for practical purposes needs experimental confirmation.

It is evident from Froude's writings that he had satisfied himself of the accuracy of the Law of the Square.

Of course the Law of Comparison is quite independent of the Law of the Square. Wave-making resistance of a ship, to which the Law of Comparison applies, does not follow any such simple law. But the Law of Comparison itself cannot apply exactly. It may be stated by saying that at the same slip at speeds proportional to the square root of the ratio of linear dimensions torque and thrust of model and full-sized propeller vary as the cube of linear dimensions. But for liquids the exact Law of Comparison requires that model and full-sized propellers should work under heads proportional to linear dimensions.

This is not the case for model and propeller in practice. The model works under a head equal to its submergence plus the pressure of the atmosphere. The propeller works under a head equal to its submergence plus the same atmospheric pressure. The result is that, though a full-sized propeller may break down through cavitation, its model at corresponding speed, working under relatively a much greater head, does not break down correspondingly, and the Law of Comparison does not apply. Fortunately, we need seldom apprehend cavitation, and the fact that the Law of Comparison fails when it is present does not seriously reduce its value in enabling us to utilize in full-sized designs results of model experiments.

Accepting the proposition that the Law of the Square and Law of Comparison apply to propellers with accuracy adequate for practical purposes, we are still to consider the fact that when driving a ship the propeller is working in water disturbed by the ship, and hence under conditions not strictly comparable with the model if tested apart from the ship, in undisturbed water. This difficulty is overcome by testing the model propeller in its proper place behind the ship model, thus reducing the discrepancies of condition to minor factors, but before considering this branch of the subject let us consider facts established by model experiments for propellers working "open," *i.e.*, apart from the ship.

A cardinal advantage of the model experiment method is that it enables us to test the effect of varying one only of the many factors affecting propeller action. When this is done on a fairly comprehensive scale we find that many past ideas as to the actual and relative importance of these factors are erroneous—some of them grotesquely erroneous.

There are still designers who attach much importance to disk area ratio and figure its effect upon efficiency regardless of other factors, usually assuming that the lower the disk area ratio the greater the efficiency.

So far as can be determined by model experiment, which is the only practicable method of investigating this factor apart from others, it is evident that such ideas are erroneous. Efficiency first goes up and then goes down as we increase disk area ratio from 0.2 or so, the best disk area ratios as regards efficiency being somewhere over 0.3, though the variation of efficiency with disk area ratio is practically negligible over a wide range on either side of that for maximum efficiency.

Perhaps the most notable fact shown by the model experiments is the great effect of blade thickness upon efficiency of model propellers—a fact practically ignored until these experiments, published in 1910.

It is almost universal practice to use blades of generally elliptical outline as developed. No merit has ever been found in freak outlines, nor do I know of any experiments or experience showing that any outline is appreciably superior to the elliptical. The question is essentially whether we should use broad or narrow tips.

We seem justified in concluding that blade outline, as long as it is smooth and fair, is a very minor factor in propeller performance, and, all things considered, the standard elliptical outline deserves to be the standard. However, for single-screw vessels where the screws must work with very high actual slip, broad tips are frequently indicated. Their larger power absorption capacity enables them to work at less slip, and the gain of efficiency associated with reduction of slip is liable to overcome the loss due to blade outline. The gain is small in any case, but worth going after when we are forced to adopt objectionably small diameters.

Efficiency is one of the two principal things we need to know about a given propeller. The second is the absorption of power.

The advantages of basing propeller design upon results of model experiment result, broadly speaking, from two sets of facts.

In the first place, by model experiment we are enabled to classify the various factors involved in propeller performance in the order of their importance, eliminate the non-essentials, subordinate those that are secondary, and determine quantitatively the influence of the only primary factors, namely, diameter and pitch. The secondary factors I would put mean width ratio, giving blade area, and blade thickness fraction, giving blade thickness. These are so secondary that by determining diameter and pitch from standard diagrams of average mean width ratio and blade thickness fraction, we obtain results that would be little changed by any likely changes in blade width and thickness.

In the second place, when we base our designs upon results of model experiments we naturally consider separately the individual factors involved, the propeller itself, the effect of the ship upon its action, and the effect of its action upon the ship. We are not yet in a position, without specific model experiment, to assess quantitatively with minute accuracy all the individual factors. But we are able to approximate to them and to consider, examine, and appraise these factors separately is essentially a sounder method than to lump them. No method of propeller design can be sound that ignores essential factors. It is obviously much more difficult to consider them lumped than separately. By model experiment only is it practicable at reasonable cost to appraise the various factors involved.

Now what of the other side? What are the objections to basing our designs upon model experiments? There is only one—the possibility that Froude's law may not apply and that the performance of full-sized propellers cannot be accurately inferred from tests of their models.

The performance of model propellers is appreciably affected by bluntness of blade edges, and there is no reason to

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believe that this is not also true of full-sized propellers. If we consider it necessary for structural or other reasons to fit propeller blades with rounding edges, we should remember that this involves some reduction of efficiency and increase of diameter as compared with propellers derived from the Standard Series sharp-edged models.

There is also the question of thickness of blade sections. Rather a startling increase of efficiency is shown as blades are thinned to about one-half the customary thickness. This is a result not easy to check with full-sized screws, but there happens to be one rather remarkable test that fully bears it out. I quote from my discussion in our Transactions for 1905 on Curtis and Hewins' paper.

"Some experiments made more than twenty-five years ago by Mr. Yarrow shed great light upon the effect of thickness of propeller blades. Mr. Yarrow tried twenty-five different screws upon a single-screw torpedo boat. Most of the screws tried were two-bladed and two were identical in every respect except that one was made with blades as thin as possible. The thin-bladed screw showed a very marked superiority to the thick-bladed screw.

"The maximum power which could be delivered with the latter was 350, and the corresponding speed for this boat 17.4 knots. The thin-bladed screw when absorbing 350 horse-power gave a speed of 19.15 knots, a gain of 1¾ knots, or almost 10 percent in speed, simply through a change in thickness of the two blades. The thin blade was so thin that it took a permanent set when more than 350 horsepower was put through it. * * *"

To sum up and speculate to some extent, it would seem reasonably certain that if we could make propeller blades without thickness, Froude's law would apply to model and propeller virtually exactly. Taking propellers as they are, it probably applies substantially exactly to propellers with fairly broad, thin, sharp-edged blades. As we narrow blades, thicken them and make their edges blunt, we are liable to get more and more departure from Froude's law. The question, of course, arises: What difference does it make?

If we are designing propellers following closely the blade section features of the Standard Series, we can expect the full-sized propellers to follow closely Froude's law and use the diameter given by the diagrams. If our blades are thicker, narrower, and blunter than the blades to which the diagrams apply, but the tip speed low, we will discount any probable departure from Froude's law by using diameters and pitch ratios 2 percent or 3 percent greater than given by the diagrams. If, furthermore, tip speed is rather high and we are approaching, though short of, cavitating condition, we may well provide a slightly larger margin of diameter and pitch ratio—say up to 5 percent.

The above applies to the ordinary propeller of commerce with blades of ogival section. As regards freedom from cavitation and close adherence to Froude's law, this section leaves much to be desired. Unfortunately, it is not practicable with apparatus available in the ordinary model basin to test the cavitating qualities of blades of propellers of normal pitch ratios. Otherwise there is little doubt that for high-speed propellers we should long since have developed sections superior to the ogival.

Discussion

CARL E. PETERSEN, naval architect, United States Lines: With reference to the matter of blade thickness, the performance of a large number of full-line cargo ships has shown marked improvement when bronze wheels are substituted for cast iron. The thickness of blades in such cases has been reduced 25 to 35 percent and it would seem that thinner blade sections are advantageous on such vessels. It would appear that more consideration should be given to the use of bronzes of 95,000 to 100,000 pounds tensile strength instead of manganese bronze having about 65,000 pounds tensile strength. Propellers of such metal are actually in service and have given excellent results.

E. A. STEVENS, JR.: I agree with what Admiral Taylor says about blade outline, provided there is room to swing a propeller of proper diameter, but if this is not possible considerably more can be gained by broad-tipped blades than Admiral Taylor seems to think. I have had experience with ships where there was not room for a propeller of sufficient diameter and have been able to improve their performance considerably by replacing wheels having approximately elliptical blades by those with broad tips. In one case the coal consumption was reduced about 10 percent with about a knot increased in speed but all the saving cannot, however, be credited to the propeller as the engine was able to operate under better conditions with the new wheel than with the old.

While there is unquestionably a loss in efficiency from blunt blade edges, I believe the following edge has more effect than the leading one.

I do not think that blade thickness, unless it be abnormal, has as much influence upon efficiency as Admiral Taylor appears to.

W. W. SMITH: In designing a propeller it is of course desirable to use the pitch, diameter, revolutions per minute, form and area which will give the highest efficiency for the data and conditions given. In my opinion it would be most convenient to have the best or optimum value for the various numbers and forms of blades plotted on one chart. Where best values are used, such a chart would in many cases suffice for design. Where conditions make it necessary to depart from the best values R. E. Froude's chart, given in his paper before the Institution of Naval Architects in 1908, should be used. Thus, only two charts would be required for solving all problems.

REAR ADMIRAL C. W. DYSON, U. S. N.: I agree entirely with Admiral Taylor in his conclusions as to the applicability of the law of comparison to propellers within certain indefinite limits.

Admiral Taylor criticizes the lumping of the propeller-hull loss factors as being unsound. All guessing is unsound, but, where we are driven to guess, the percentage error resulting from one guess would be less than that resulting from the summation of errors in several. Where the vessel is an important one, the power high, and the hull of such form as to produce heavy losses due to obliquity of flow of the water to the propeller, the wise man will always check his estimate of the performance by trial of the self-propelled model.

Personally, I am of the opinion that there is a very close relation between the Taylor and the Dyson methods of design and that by a little investigation the two methods could be combined into one.

The Probable Effect Upon Ports of the Probable Growth of Ships

By Commander John H. Walsh (C. C.), U. S. N. (Retired)

This paper will be published in a later issue.

Discussion

JOHN H. BERNHARD: I have always felt that ports are at the mercy of the trend of the times and that ships built in accordance with these will always dictate the conditions of the port.

SAMUEL YOUNG, chief engineer of the Port of New Orleans: Commerce is growing by leaps and bounds and millions upon millions are being expended for ships and for the development of ports. It does not follow that because a certain stage of development will be demanded ten, twenty or thirty years hence, great sums should be expended for arriv-

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ing at these results immediately. On the other hand, future building, both of ships and ports, should not be haphazard and without regard to ultimate limitations.

MAJOR LANSING H. BEACH, chief engineer, United States Army: I am not prepared to agree with the view expressed or implied, that in the long run ships will not be limited in growth by the accommodation in ports. Even assuming that the economics of water transportation should tend to produce an indefinite growth in the size and draft of the average cargo ship, the question of whether the ports of the world as a whole will so increase channel depths as to permit the construction and operation of such great ships is wholly a quantitative one based on relative costs and savings. Moreover there is no present indication that the ordinary cargo ships will in the near future attain dimensions at all comparable to the few very large vessels of the type illustrated in the paper. The present tendency is for the ordinary cargo ships to increase in size but by no means to approximate to the small group of exceptionally large vessels now confined principally to the liner trade between New York and certain European ports.

MAJOR JOHN W. M. BLACK, U. S. A. (Retired): I would suggest that a better title to a paper of this kind would be "The probable Effect of Ports on the Future Growth of Ships" for really the ultimate controlling factor must be the dimensions of the channels leading to the ports and the capacity of the ports to absorb and supply cargo. The increase of the depth of ports is not impossible but the cost of such an increase is so great that in most cases the annual interest on the investment required for the work would exceed the savings to be effected by the use of the deeper and longer vessels. Port improvements are more and more becoming public works with expenditures made from public funds and it is essential that they be economically justifiable. Increase of channel dimensions and of port capacities should be made only when their cost is demonstrably less than the savings to the public which such increases would produce.

CAPTAIN F. T. CHAMBERS (C. E. C.), U. S. N.: I do not think that too much weight should be given to diagrams based upon the largest single ship of succeeding years. Of course it is a fact that smaller ships have a marked tendency to become larger ships but, with the exception of the passenger liners of the so-called Atlantic ferry, and a more limited number of oil and ore cargo ships plying between fixed ports, where special facilities have been built to accommodate them, there is almost none which exceeds in draft the limit set (32.2 feet) in the proposed resolution of the 1912 International Congress.

PROFESSOR WILLIAM HOVGAARD: The question raised is one of mutual action and reaction between ships and ports and it is difficult to say which is the stronger. In any case, it is certain that the moving force comes from the ships and this I believe is due to the fact that there is a steady growth in the world's trade and more particularly in the ocean-borne trade of the United States. Just so long and in the same measure as the expansion continues of the world's trade and therewith of its sea-borne commerce, just so long and in the same measure will merchant ships of increasing size be able to obtain full load of freight and passengers.

As regards warships, I believe that if no artificial restrictions were imposed, their displacement would still go on increasing.

CARL E. PETERSEN: Taking into account the numerous factors to be considered, there is probably a limit of size of passenger vessels which cannot be exceeded but I venture to say that in all probability the thousand-footer will be the largest vessel that port authorities will be called upon to provide facilities for, a vessel of this length becoming a reality only with economic conditions favoring it, which is not the case at present and probably will not be in the immediate future.

It was pointed out by Captain Land that the adoption of Diesel engines might have some effect on the future size of ships and by Professor Sadler that in any event economical development could not in the long run be restricted or limited by legislation.

The Economics of Transatlantic Liners of Various Lengths

By Carl E. Petersen

This paper is published on page 759 of this issue.

DISCUSSION

REAR ADMIRAL D. W. TAYLOR: Mr. Petersen, upon certain basic assumptions, has developed in a logical way the results to be expected from mixed-type vessels of various lengths and corresponding displacement. He explicitly states that his work applies to existing conditions and I want to emphasize that fact because a change in basic conditions changes entirely the conclusions. When one looks at a diagram showing the steady increase of length and displacement for transatlantic liners for seventy years past it rather compels a belief that the change of conditions in the future as in the past will favor the large vessel. It is sixty years since the *Great Eastern,* nearly 700 feet long, in the day of 300-foot liners, was a financial failure, but the 700-foot liner has now been with us and successful for some twenty years or so. For the purpose of the author he was fully justified in assuming that the passenger performance falls off with the length of vessel but is that necessarily the case? It may be for the type discussed in the paper where the 1,000-foot vessel makes less than 24 knots but, if the vessel were built to take advantage of her exceptional length by showing exceptional speed, it seems certain that her passenger performance would improve most decidedly.

I believe that if we can judge the future by the past the growing North Atlantic passenger travel will be accommodated by ships averaging longer and larger than present optimum lengths.

WILLIAM T. DONNELLY: Too little consideration has been given to the load factor; that is, a larger ship would pay, if she could be consistently and continuously loaded to capacity and it is quite apparent, as pointed out in this paper, that our ships of maximum dimensions have passed beyond this possibility.

Machinery Trials, Coast Guard Cutter Modoc

By Captain Q. B. Newman, Engineer-in-Chief, U. S. Coast Guard

This paper will be published in a later issue.

DISCUSSION

Mr. C. P. Wetherbee, who had officially represented the Society of Naval Architects and Marine Engineers on this trial, made a report, drawing attention to the fact that he was merely an observer and, furthermore, that the trial confessed to be simply an attempt to obtain accurately essential facts and that no conclusions in regard to the particular type of machinery under test were drawn.

CAPTAIN ELLIOT SNOW, (C. C.), U. S. N.: It is not often that an official occupying the position of Captain Newman can find the time to lay out and then personally supervise trials of this character. That this was the case in the present instance lends added weight to the data recorded in the article.

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I would like very much to see added to this article the combined generator and motor torque curves during reversal for which this installation was designed. These would help in arriving at an adequate explanation of the difference in performance between backing trials Nos. 1 and 2. I would like to get the views of the author, or some other propeller expert, on the following point: Will a propeller under such conditions absorb full power and correspondingly check the vessel from going ahead, or will it simply churn the water for an appreciable interval and thus nullify to a large degree the advantage of full backing power that is claimed for electric drive?

T. B. STILLMAN, Babcock and Wilcox Company: For the forced draft run No. 7 it was a relatively easy matter to obtain steady conditions in the fire room. On the contrary, during the natural draft run the course of the ship was changed several times, this affecting the available draft at the boiler uptake by nearly 100 percent on account of the variation of the direction of the ship with respect to the wind. As the amount of oil which could be burned is directly dependent on the draft available, it was necessary to vary the oil pressure from 165 pounds to 270 pounds per square inch in the effort to keep a satisfactory balance between the air being drawn through the burners and the oil being sprayed through them. This marked fluctuation in the rate of feeding the air and oil caused very natural fluctuations in the rate of flow of feed water and the pressure of steam coming from the boiler, both of these conditions being detrimental to best efficiency results.

In addition to the unsatisfactory operating conditions indicated, it should also be kept in mind that through the open fire room existing during natural draft operations there is a larger loss from the boilers due to radiation than when the fire room is closed. Thus, if the operating conditions existing during both tests are thoroughly understood, it can be appreciated how the large difference in efficiency between the two tests was secured.

Taking the trial results of the boiler as a whole, I believe we could safely say that the results are satisfactorily consistent in view of the conditions under which the tests were run as compared to those usually obtained when boiler test data are secured.

Aside from the immense value of Captain Newman's paper to the marine engineering profession in general, I feel it is of particular interest from a boiler operator's point of view, as it is very unusual to obtain as complete results from boilers operating under service conditions, as were obtained during these trials.

W. W. SMITH: Special attention is called to the rapid increase in fuel consumption below the full speed. This is due principally to insufficient blading in the turbines to absorb the energy in the steam efficiently at reduced power. It is a common fault in marine turbine installations. There are eight impulse stages in this turbine. Cross-compound turbines as used with gear drive usually have considerably more blading.

The auxiliary steam consumption, exclusive of exciters, is larger than usual on merchant vessels and seems rather excessive for an installation of this kind.

The steam consumption of the exciter unit is 14.5 percent but only about 12 percent is used for the main transmission. Due to utilizing the exhaust from the exciter unit in the lower stages of the main turbine, only about 60 percent of this loss is chargeable to the transmission gear, thus there is about 7 percent loss due to the exciter steam consumption alone which must be added to the loss in the main transmission gear. If we allow 8 percent for the latter, the total loss in transmission will be about 15 percent. This does not compare very favorably with about 3 percent loss for a double reduction gear.

Admiral Griffin, U. S. N., noted the apparent lack of economy of auxiliaries, particularly that of the electrical units connected with the main propelling motors and stated that it would evidently be advisable to design special exciters for this class of work.

Mr. E. A. Stevens, Jr., and Mr. Maxwell Day, of the General Electric Company, also made some general remarks upon the paper and the value of the data which it contained.

The Manufacture of Heavy Steel Castings for Ships, with Special Reference to Stern Frames, Rudders, Shaft Brackets and Stems

By Hugo P. Frear

ABSTRACT

The general process of making fluid steel for castings is more or less well understood by a large percentage of the members of the Society. Great progress in the manufacture of heavy steel castings for ships in the past several decades has been made towards a reduction in the percentage of losses on account of defects or failure to meet specifications. This is due in a large measure to advancement in the art of making steel, greater attention to design and the location of sink heads, more general use of chill plates, and more careful and intelligent work in the foundry. General foundry practice and the materials used, however, have changed but little. The problem of making steel castings over the above period was well understood. Steel foundry operations of molding, core-making, pouring, etc., are very similar to those employed in the iron foundry. In the early days rolled and cast steel were equally unreliable on account of the poor quality of the product.

The difficulties in making good steel castings are and always will be greater than making iron castings. These greater difficulties are inherent for several reasons. Fluid steel is necessarily hotter, cools more rapidly, shrinks more and contains more gas than iron. On this account it is necessary to give more careful consideration to design, to the preparation of the mold, and to use a more highly refractory sand.

As already stated, the melting point of steel is higher than for cast iron and the shrinkage greater. Both the melting point and shrinkage vary more or less inversely as the carbon content. It therefore follows that the lower the carbon content the higher the melting point and the greater the shrinkage. Low silicon also increases shrinkage. As steel chills more rapidly than iron, this may also be attributed somewhat to the lower carbon content. It may be concluded, then, that a large part of the difficulties in making steel castings as compared with iron is directly due to the lower carbon content.

It is common knowledge that the shrinkage of steel is a variable quantity even in the same casting. This is more evident in long castings. There is no way to accurately estimate the shrinkage to allow at different points of the pattern. A stem casting is one of the most difficult to make so far as predicting correct shrinkage is concerned.

Shrinkage may be affected by variations in thickness and temperature of metal at different points of the mold. The temperatures are affected by thickness and by the way the metal is run in the mold. If the gates are not well distributed, the metal in some parts may be much cooler and almost ready to freeze by the time it has filled the mold. At the thicker parts of the casting the outer layer, next to the mold, chills quickly, while the inner layers are still fluid and hotter. When the second and hotter layer freezes on to the first layer, the latter is stretched, because there can be

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no sliding between the two layers and then the shrinkage is less than it ought to be.

Steel is said to shrink about ¼ inch to the foot, but in practice frequently varies from ⅛ inch to ¼ inch per foot.

Many of the members of this Society can look back to the time when stern frames, rudder fraces, and stems for merchant steamers were almost exclusively forged of iron. Both steamship lines and builders were slow to change from iron forgings to steel castings.

It is a mistake to believe that internal stresses or serious defects do not occur beneath the surface of heavy iron forgings, especially if made of material of doubtful quality. Broken posts or shoes have occasionally revealed these defects.

Under the great building programs of the war, iron forgings in quantity were impossible. The art of making these forgings required greater skill than could be created for emergency war work. Not only were the plants equipped to make such forgings of small capacity and few in number, but good iron was practically unobtainable. The increasing use of cast steel and scarcity of good iron scrap offered little inducement for plant extension or for younger men to take the places of those who had grown old at the forge. Even most of these older men, like Othello, lost their occupation during the war and have disappeared. Iron forging, therefore, on account of the diminishing demand before the war, followed by the almost exclusive use of cast steel, has practically become a lost art.

Before the design for a large and especially a complicated steel casting is finally approved the traffic man, patternmaker and molder should be consulted. Shipping facilities and clearances in tunnels and under bridges frequently necessitate making the casting in several parts or the elimination of foundries less fortunately located in this respect.

The designer, patternmaker and molder should have a thorough knowledge of shop conditions, shipping facilities, and the difficulties previously encountered on work similar to that in hand. The patternmaker and molder should be acquainted with the action of the fluid steel in filling the mold, and in cooling so as to anticipate and guard against eventualities which experience only can predict.

In laying out the castings, simplicity should be kept in mind. Abrupt and sudden changes in shape, sections and masses should be avoided to the greatest possible extent. Where comparatively large masses of metal cannot be avoided they should be well tapered off into the thinner sections. Large fillets should be provided at all flanges and intersections. Flanges and webs or ribs should be designed with proper draft to facilitate drawing the pattern and pulling out the drawbacks.

Experience has indicated that castings frequently come out over-weight unless steps are taken to prevent it. To offset this, castings, in which weight saving is important, have deliberately been drafted lighter than specified. In recent cases, parts have been designed from 1/16 to ⅛ inch under requirements, according to thickness, and on being checked found to meet specifications.

Although the designer may have consulted the patternmaker and molder before issuing the plans, it is often customary for the patternmaker and molder to consult freely during the construction of important patterns. The foundry should receive the first consideration in deciding upon the methods of molding and the best type or construction of the pattern for performing the work. It is false economy for the patternmaker to try and save a little money on the pattern at the expense of the foundry.

After the patternmaker and molder have agreed upon the type and method of making the pattern they should jointly estimate the shrinkage which may vary somewhat at different points.

If patterns are shipped any distance, they should be properly braced and checked before shipping and again checked at the foundry.

The facing sand used in making the mold and cores must be capable of resisting the high temperatures without fusing and sticking to the casting or spalling. It must be porous to facilitate the escape of gases generated in the steel while cooling, or by contact with moist sand. Gases trapped in the metal result in blow-holes. There must be sufficient cohesion for ramming and stability for retaining form under the ferrostatic pressure of the molten metal.

An ideal sand, in order to possess the greatest possible permeability for the escape of gases, should be composed largely of grains of uniform size and of smooth, well-rounded form. It is obvious that a sand of this ideal character would not possess the necessary cohesion to retain its form without the addition of some finer material for a binder. It is also obvious that the smallest possible quantity of binding material should be used to give the greatest permeability. With the exception of a small amount of burnt sand, used only for economy, new materials should be employed.

Pure silica or crushed quartz sand (from 95 to 98 percent silica), mixed with a little burnt sand and core compound or clay, approximates these requirements. For large castings the facing sand is from 1 to 2 inches thick, according to the thickness of metal.

There are comparatively few cores used in the manufacture of the large steel castings included under the title of this paper which present as serious problems as those frequently encountered in designs requiring cores of greater area and length.

Effective venting in cores is more important even than with the mold itself. The mold surrounds the casting on the outside, and the gases have more freedom to escape outward through the sand than inward through the cores.

Flasks are boxes or containers which hold and support the sand forming any part of the mold. Cast iron, cast steel or rolled steel, on account of their durability and strength, are exclusively used in making up flasks for large steel castings. Some steel castings for ships are now so large and require such deep flasks that entirely new sections or complete special flasks have to be made.

The several types of large steel castings for ships are so different and the variety of design for each so great that a detailed description of the foundry practice for every case would be out of the question. There is a most excellent series of articles describing actual examples of molding heavy steel castings for ships in *Foundry,* Vol. 47, 1919, by Ben Shaw and James Edgar, and, for those interested, would well repay reading.

Pouring should be done as early as practicable after the mold is fitted up before it has had time to absorb moisture, and preferably while it is still warm. The getting ready of the ladles and the final adjustment of the heat should be timed for this event.

Sinkheads, risers or feeders, as they are sometimes called, may be termed a necessary evil in the production of sound steel castings. The large percentage of scrap in the sinkheads and the expense of cutting them off is one of the important items in the cost of steel castings. The main function of sinkheads is to increase the ferrostatic head in the mold and feed fluid metal into the shrinkage cavities, created during contraction.

It requires good steel and good foundry practice to produce sound castings, but these are not sufficient to guarantee uniformly good results when, on account of the design, nothing short of a miracle will do the trick.

If the design is such that the lighter sections are at the bottom and the pouring is done slowly from the top, the conditions would be ideal. The cooler metal and first chilling would be at the bottom and gradually work upward. Shrink-

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age cavities or pipe during contraction formed first at the bottom would be fed from the casting and also gradually work up to the top where the final feeding would come from the sinkhead.

In the manufacture of steel castings there is unfortunately a large percentage of rejections on account of defects. It might not be an exaggeration to say that the closest scrutiny might reveal minor defects, more or less important, in almost every large steel casting. The foundryman can, however, take some consolation from the fact that many of these can be salved by electric welding or other means.

The various characters of defects, resulting in rejections, arranged approximately in the order of their importance, are shrinkage cracks, shrinkage cavities or pipes, blowholes, surface imperfections, warping and cold shuts. Shrinkage and gases are, therefore, the chief offenders as far as the more common defects in steel castings are concerned.

Hot metal, sudden changes in thickness, small fillets, sharp corners, quick bends, webs, flanges, internal stresses from uneven cooling, and unyielding molds and cores all contribute to the possibilities of shrinkage cracks.

These most frequently occur between heavy and light sections, in fillets, corners and at bends.

If shrinkage is estimated at ¼ inch per foot, the contraction and the necessary yielding of the mold in a length of 24 feet would amount to 6 inches. The distance between the top and bottom gudgeons on the stern frames of many merchant steamers is at least 24 feet. It is therefore apparent, if cracks are to be avoided, that the mold must yield, in this case, about 6 inches between these two points, provided the casting is not stretched in the manner above referred to.

The writer has been informed that probably in the case of 75 percent of ordinary merchant steamers, on, or after, going into commission, small cracks exist either at the top or bottom or at both top and bottom of rudder gudgeons. It is also stated that these are being continually electric welded in dry dock.

Surface defects are usually found on the upper surfaces of the castings. They are caused by loose sand floating to the top and becoming imbedded in the surface of the metal. This loose sand may have been washed off by the running metal as the result of imperfect drying, spalling off of patches, insufficient nailing of the cope and the bottom of sprues on other parts where erosion is excessive. Sand or dirt not thoroughly blown out before closing up the mold will produce the same evil effect. Sand of low refractoriness will soften and burn into the casting. The effect of this will not be limited to the upper surfaces but show over the whole casting.

Warping is generally the result of internal stresses set up by uneven cooling or from sagging on account of not being properly supported in the annealing furnace.

Cold shuts result from cold pouring. If the metal running around cores or from different gates is too cold when the streams meet, they will not make a perfect union. This fault is termed a cold shut.

Steel castings of the kind under consideration are rarely rejected now on account of shrinkage cracks or cavities and blowholes where satisfactory repairs can be made by welding. When electric arc, oxyacetylene or thermit welding were in their infancy, prejudice against them was so general that many of the castings now salved would have have gone to the scrap pile.

The art of welding has become so well understood that it occupies a recognized place in the steel foundry and for making repairs on vessels in commission. A skilled arc or torch operator should have no difficulty in making a perfect weld. If any poor metal is run in, he knows it and should cut it out. He should not proceed to cover it up.

Large cracks or breaks should preferably be repaired by thermit welding.

Whichever process of welding is adopted, all bad material and sufficient steel in way of cracks should be cut out so that the parts can be thoroughly preheated and space provided for running in the metal.

Welding metal is run in so hot that a hard crystalline structure extending into the casting results. It is therefore advisable to do all possible welding before annealing. Castings on which important welding has been performed after annealing, or that require machining in way of the same, should be properly annealed again after welding where possible.

The judgment and experience of the manufacturer must be relied upon in deciding the procedure to be followed in shaking out a large casting. This depends on how soon or to what extent it would be safe to subject the individual casting to air cooling and on the practice of the foundry in the construction of the mold and cores in respect to automatic yielding or collapsibility. Too early exposure to the air, in many cases, would aggravate the internal stresses with the probability that either serious cracks or innumerable infinitesimal cracks too small to be distinguishable might be developed.

Cleaning and cutting off of runners, gates, risers, fins and brackets, etc., should be completed and the casting made ready for the annealing pit or furnace as quickly as possible.

All cast steel has a coarse crystalline structure and is subject to internal stresses before annealing. The object of annealing is to improve the texture of the steel by breaking up this coarse crystalline structure, relieve the internal stresses and also soften it for machining.

No hard and fast rules can be followed in deciding when castings should be placed in the annealing furnace. If castings are cooled and thoroughly cleaned before annealing, the welding up of visible defects can be first completed.

With castings of complicated design rapid or uneven cooling might result in cracks at any stage of cooling after pouring. In such cases and where proper facilities exist it would probably be safer to get the casting into the annealing furnace as hot as it can be safely handled.

As a safeguard against sagging or warping in the furnace, the casting should be supported on blocks of small area, spaced widely to allow free heat circulation under the casting, but close enough to avoid too large spans between supports.

There are so many different designs of large steel castings for ships and warping is so erratic that each case of straightening usually presents a special problem. Sometimes the design, thickness of metal and extent of warping admit of cold straightening. In most cases this can be done better and with greater safety under an hydraulic press. In many cases local heating has been resorted to in straightening and taking out twists in castings of simpler design. The temperature of the local heating should not be greater than necessary to accomplish the purpose and should preferably be kept below the annealing point.

DISCUSSION

M. C. HUTCHINSON, of the New York Shipbuilding Corporation: The welding of defective castings will seriously delay our progress toward proper steel making besides presenting unknown dangers. The welding of new steel castings is a makeshift that records failure. Mr. Frear is right in saying that the designer should be kept in touch with the molder in making his designs but too much of the burden of responsibility should not be placed upon the designer for it should be his business to meet the demands of economy by designing castings as light as he can but strong enough and of such shape as to secure the strength with the least weight. Ship castings are frequently designed with twice the weight necessary for strength in order to get a good casting. This is not so important in castings used for buildings and bridges but is a vital matter in ships.

H. E. DILLER, metallurgical editor, *The Foundry*: In this

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connection it is interesting to note that after many years of specifying definite limits for the percentages of phosphorus and sulphur allowable in steel some of the leading engineering societies of the country have a joint committee investigating the effect of these elements on different steels. This investigation is of huge magnitude but, when finished, it will be valuable to substantiate the conclusions drawn. It is only by the cooperation of the designing engineer, the patternmaker and the foundryman that the maximum of success can be obtained.

It seems a great benefit to the industry to be able to weld castings which formerly had to be discarded but the benefit will be reduced, if the ease with which a casting can be welded reduces the interest of the foundryman in producing a perfect product. I would suggest that it would be an excellent thing that, where opportunity permits, further investigation be made in the question of the relation between porosity and the percentages of sulphur and phosphorus.

DAVID ARNOTT, American Bureau of Shipping: My own experience in the survey of ships has convinced me that large cast steel stern frames would require to give better results under the test of operating conditions before they can be considered to be in the same class with forged iron frames so far as reliability in service is concerned. The ship castings produced during the war can be grouped into three classes—good, bad and indifferent—and I am afraid that a large proportion were in the latter category. It is certainly interesting to learn that the art of welding now occupies a recognized place in the steel foundry but I rather think that the production of sound steel castings will never become an exact science, if the foundry is given blanket approval to use welding for the repair of major defects. The place for major welding operations is a drydock or repair shop—not the foundry.

H. F. NORTON, naval architect, Newport News Shipbuilding and Dry Dock Company: We have found so many large castings out of shape in a sidewise direction, where the symmetry seems to preclude the idea that shrinkage is the probable cause of the trouble, that we have come to believe that the matter of adequate support in the annealing oven is worthy of considerable further study.

Fuel Conservation and Engineering Performance Standards by Shipping Board Vessels

By Joseph E. Sheedy

This paper will be published in a later issue.

DISCUSSION

W. W. SMITH: In general the method described is thoroughly practicable and very simple. I consider it the best method I have seen for determining the general performance of a vessel. It should be of special interest and value to ship operators in checking the performance of their vessels and keeping up the efficiency of the engine room crews.

CAPTAIN ELLIOT SNOW, (C. C.), U. S. N.: The author correctly and wisely points out in the summary that the standards given are not absolutely correct. The curves are necessarily approximations and their use is of relative value only. Errors will affect all vessels alike and hence not be averse to a particular vessel of the group. It is to be hoped that the author will be able to supplement this article with curves and performance data prepared for the *Eclipse, Archer, Invincible* and other vessels of this class both before and after their conversion to electric drive.

R. W. MORRELL, marine superintendent, Tide Water Oil Company: The use of observed miles instead of engine miles as a basis for the unit of measure appears to me to introduce unnecessary complications. While it is true that the efficiency of a vessel as a whole is the ultimate consideration, it is really the efficiency of the engineering department we are getting at and through which it is hoped to accomplish the real results. It seems to me to be preferable to segregate this engineering efficiency by confining the consideration to engine miles and thus eliminating all such uncertain variables and assumptions as are involved in the condition of the bottom, seamanship, the skill of the helmsman and the effect of currents. Suppose a ship does fall short of her theoretical miles per ton, no one can say definitely whether it was because the ship was kept bucking into a head sea instead of easing off a little and making more mileage with less labor or whether the fault lies in some adjustment of burners or links. There is some question in my mind about the basis of the correction factor applying to shaft horsepower for various depths of loading. I believe a more rational basis for applying the correction would be simply on percentage of the full load draft, leaving out the beam entirely. It is noted that the trim of the vessel has not been taken into consideration and this leads me to wonder whether certain factors are not carried to too great a refinement while ignoring others of equal importance. Improper trim is a serious handicap to any vessel, both as to propulsion and steering qualities. I am sorry Mr. Sheedy did not go further in his paper and describe the methods used in making practical applications of the data obtained, as I find this to be the most interesting part of the problem. Knowing a ship to burn too much fuel, what are we going to do about it? It is only by careful study of log abstracts and indicator cards, as well as inspection and by a process of elimination that the real trouble can be located. I must say that the work of the committee impresses me as most admirable and I would strongly urge that private shipbuilders and operators adopt similar methods.

Some Considerations on the Conversion of Steamships to Motor Ships

By Robert Haig

ABSTRACT

In considering the question, building motorships or converting steamships to Diesel motor-driven ships, American shipbuilders and shipowners have had a peculiar situation to deal with. The Shipping Board owned and held for disposal an enormous number of ships, most of which had been constructed during the war or immediately succeeding the war, and which were more or less acceptable as merchant ships in the ordinary run of business. Owing to the conditions arising in the oil industry during the latter part of 1922 and the first half year of 1923, a very firm market developed for oil tankers for a time, affording the Shipping Board an opportunity to dispose of probably 60 percent of the then existing fleet of tankers. The number of tankers sold has relieved the pressure on the market for that type of boat, and results have demonstrated the fact that, with a general increase of this business, the tanker market will shortly be found to be very bare of tonnage.

One of the first questions we had to consider on the conversion of an oil tanker to motor drive was whether the vessel should be arranged for Diesel electric-driven auxiliaries or adopt steam auxiliaries by retaining one of the main boilers and such of the present steam auxiliaries as were suitable for the new conditions. The arrangement with steam auxiliaries reduces the cost of conversion if the units already on board are in good condition and can be worked into the new scheme of things found on a Diesel motor-driven ship, but such an arrangement, while it shows very gratifying results in economy of operation and a certain

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reduction in cost of conversion, can hardly be expected to give such favorable returns as we have a right to expect will be obtained in a more complete Diesel unit.

When the shipowner who handles cargo and passenger ships deals with the question of fitting Diesel motors, he is not immediately concerned with the consideration of retaining boiler power, beyond such small power as might be required for purposes of heating, which is only a minor matter.

In dealing with a general cargo boat, the same considerations have not had to be given to cargo handling as in the tanker, as we have no difficulty in obtaining electric-driven winches, windlass and steering gears of the highest type, which we have every reason to believe will be found much more economical in maintenance. With the electric auxiliaries, steam for power purposes can be entirely eliminated, and we thereby obtain the best conditions for a Diesel motor installation, as there is no question of doubt but what an all-Diesel installation is the ideal outfit.

Our experience has shown us that the ships now owned by the Shipping Board can, with very great advantage, be converted to Diesel motor-driven ships, and it will be found later that in the higher powered passenger boats the savings in fuel and space will be still more substantial. The adaptability of the general run of the Shipping Board ships to Diesel motor ships is admitted, and several shipbuilding firms are working on different types at the present time.

The Sun Shipbuilding & Dry Dock Company in the early part of the present year, in the adjustment of their business with the Shipping Board, purchased from the Shipping Board two oil tankers with Scotch boilers and geared turbines, 10,200 tons deadweight, and one general cargo boat, 11,800 tons deadweight with Scotch boilers and geared turbines, with the intention of converting these vessels from steam drive to Diesel motor drive, by removing the existing steam machinery and installing a Sun-Doxford 2-cycle opposed piston oil engine of 3,000 shaft horsepower each. The tankers have been dealt with first.

The main engines and the center and starboard main boilers of the two tankers were removed, and such steam auxiliaries as were unsuitable for the new power were also removed. The existing auxiliaries that were retained were relocated, and new foundations built and such other auxiliaries as were required were provided for, the main engine foundations were built and a new main motor of the 4-cylinder type, 3,000 shaft horsepower installed, with the new auxiliaries. The whole of the machinery was installed within the confines of the original bulkheads when the vessel was taken over. A new stern tube and shaft was fitted for the increased power put into the vessel over and above that previously developed with the turbines. The engines worked uncommonly well, without the slightest vibration. I may state that we were without data as to whether these hulls would set up vibration with this machinery being so far aft, but we were agreeably surprised to find that the working of the machinery developed a steadiness beyond that obtainable, even with our quadruple engines.

The M. S. *Bidwell* also had motors of the same size and type installed as on the *Miller County,* and after the necessary dock trials and river trial this vessel was sent on a trip to California. Neither of the motors in these two vessels had any shop trials on a test bed, yet they worked at the first trial and each succeeding trial without any failure whatever.

There is nothing mysterious in the construction of Diesel motors that need deter shipowners from adopting this type of power; the foremost marine motors on the market today are the product of good design and workmanship based on sound engineering principles. We are all familiar with the various developments from the low-pressure compound up to the present-day geared turbine, causing revolutionary changes, and at each step an improved economy was sought after; sometimes the gain was small, not exceeding 5 percent, and it is not overstating the case when we assert that the gain from the compound engine up to the geared turbine of today has not exceeded 20 to 25 percent, taking all sizes of steam power on an average basis, yet the gain at each step was sufficiently encouraging to go forward. The shipowner was keenly alive to the value of the lowered fuel cost per horsepower and willing to invest his money in ships that would reduce his fuel bill and machinery weights.

If such economies were considered sufficiently advantageous to warrant investing in a new type of power, how very much more attractive from an earning standpoint should the Diesel motor be considered when we can offer the owner a saving in fuel alone of 55 to 65 percent. Further, when we consider the many advantages a lower fuel consumption means, it can be appreciated that it is not only lessened cost for fuel consumed that improves earnings, but less fuel consumed means less fuel accommodation in the shape of bunkers required, less fuel carried means an increased capacity for more cargo carried and a greatly increased steaming radius of the vessel.

The following known weights are set down for comparison only, but are fairly accurate:

ESTIMATED WEIGHTS OF PROPELLING MACHINERY FOR TANKERS

	Weight of Machinery, Long Tons	Fuel Oil Required for 25-Day Trip	Total
S. S. *Bidwell*, 10,200 D.W.T., 3 Scotch boilers, 2,700 S.H.P., turbines, gears and steam auxiliaries, including water in boilers	580	800 tons—boiler	1,380
Duplicate of S. S. *Bidwell*, 3 Scotch boilers, 3,000 I.H.P., triple expansion engine and steam auxiliaries, including water in boiler.....	670	875 tons—boiler	1,545
S. S. *Bidwell*, 1 Scotch boiler, 3,000 I.H.P., Sun-Doxford Diesel engine and steam aux., including water in boilers.....	758	375 tons—eng. and boiler	1,133
S. S. *Penna. Sun*, 13,000 D.W.T., 4 Scotch boilers, 4,500 I.H.P., quad. exp. and steam aux., including water in boilers.....	1,000	1,200 tons—boilers	2,200
Duplicate of *Penna. Sun*, 1 Scotch boiler, 4,500 I.H.P., Sun-Doxford Diesel eng. and steam aux., including water in boilers.....	1,007	725 tons—eng. and boiler	1,732
Duplicate of *Penna. Sun*, 1 small vertical boiler, 4,500 I.H.P., Sun-Doxford Diesel engine, Diesel and elec. aux.....	980	530 tons—boiler	1,510

The weights here set down for tankers with steam auxiliaries and steam heating and cargo pumping outfit indicate the minimum of structural changes due to conversion to Diesel motor drive which are probably the least favorable conditions, yet they show remarkable savings over the steamer, but it will be noted when we consider the straight Diesel motor drive with electric auxiliaries throughout deck and engineroom that we get economies in weight and fuel required that amply repay the extra investment.

One further advantage the shipowners should bear in mind in considering the question of converting steamships to motor ships is the increased value of the shipping property, fitted with the Diesel motor. And we are forced to agree that as the number of motor vessels increase the value of the steamer will rapidly decrease.

The Sun Shipbuilding and Dry Dock Company is building the Sun-Doxford opposed piston two-cycle Diesel oil engine closely to the plans and data as furnished by Wm. Doxford and Sons, Ltd., Sunderland, England, out of their long extended experiments and research.

The motors built and installed by the Sun Shipbuilding and Dry Dock Company on the M. S. *Miller County* and M. S. *Bidwell* are the usual Sun-Doxford 2-cycle opposed piston type, 4 cylinders, 22¾-inch diameter, stroke of each piston 45½ inches, 3,060 shaft horsepower at 90 revolutions per minute. Weight of machinery, including fuel pump, flywheel, thrust shaft and Kingsbury thrust, 370 tons. The main motors for the M. S. *Challenger* are of the same size and type. This vessel, however, will be fitted with Diesel electric auxiliaries.

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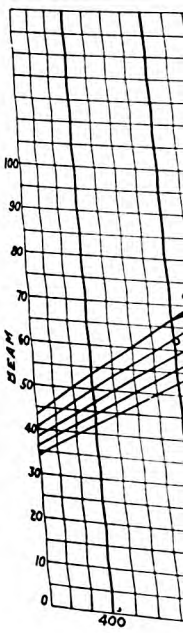

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Economics of Transatlantic Liners of Various Lengths*

By Carl E. Petersen†

In view of the desirability of augmenting the present tonnage of the American merchant marine with vessels of the moderately large and fast passenger and cargo types, in order to make our marine a more balanced one, and because of the interest which is now manifested in these types, this paper has for its object an analysis of revenues and operating costs with a view to determining approximately how large a vessel could be built and profitably operated in the North Atlantic service under existing conditions. Needless to say, the analysis is based on observations and studies made during several years of close association with the variegated types of passenger vessels comprising the fleet of the United States Lines.

A PASSENGER or combination passenger and cargo vessel is primarily designed, constructed and placed in service for the transport of the maximum number of passengers, of the maximum amount of freight-earning cargo and mail, at a minimum expense, and hence, with maximum return to the owner on his outlay. It therefore follows that, granted proper operation, the financial success of a vessel in a particular trade involves or depends upon a predetermination of the needs of the trade for the average life of the vessel and the suitability of the vessel, both as regards first cost and design, for that particular trade. The predetermination of the volume, class and time of passenger travel as well as cargo and mail transport is based upon general conditions and the owner's records.

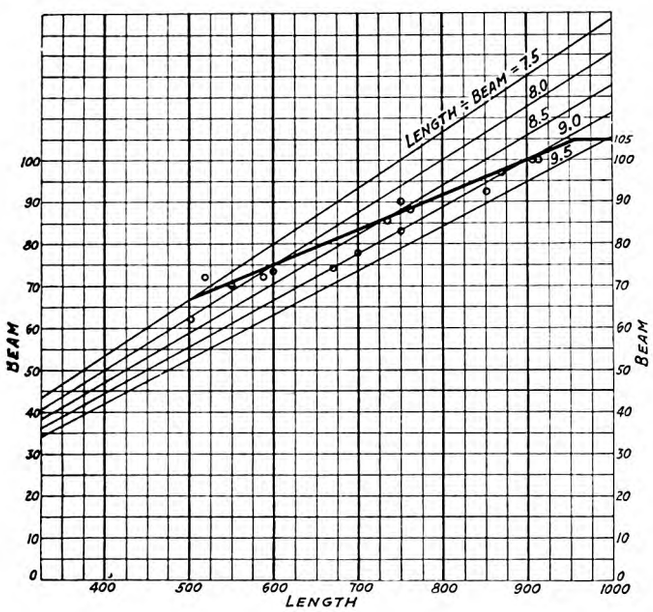

Fig. 1

Method of Analysis

The method adopted in the analysis was that of taking vessels from 500 feet to 1,000 feet of various lengths, determining dimensions and particulars which could be considered comparatively proportionate, and then preparing estimates of probable revenues and expenditures, using factors based generally on the performances of similar vessels in the same trade.

Length.—The length used is the perpendicular or underwater length, but in the case of the 1,000-footer the underwater and overall lengths are approximately the same in order that that vessel may come within the limits of the Panama Canal locks.

Breadth.—The ratio of length to breadth has been found to increase with increased length in representative North Atlantic liners, the curve, Fig. 1, illustrating this. For this reason, a ratio length to breadth of 7.5 has been taken for the 500-foot vessel, increasing proportionately up to a ratio of 9.0 for the 900-foot vessel. A breadth of 105 feet has been used for the 1,000-footer, this being again a Panama Canal limiting size.

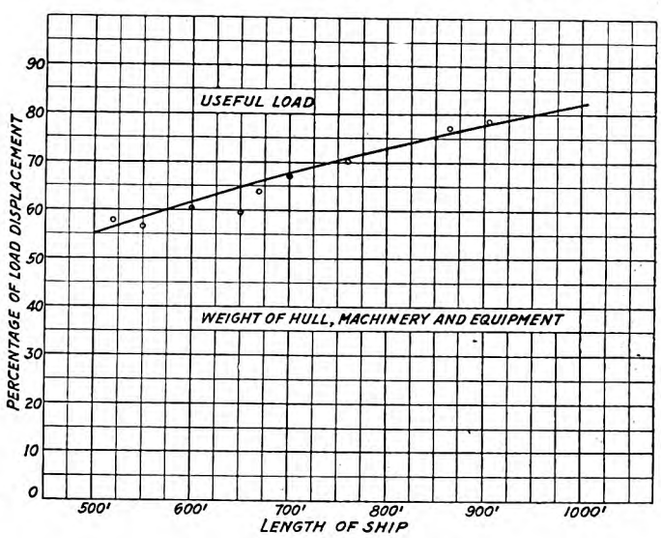

Fig. 2

Draft.—A ratio breadth to draft of 2.5 has been used for all vessels.

Block Coefficient and Speed-Length Ratio.—A block coefficient of 0.68 in conjunction with a speed-length ratio of 0.75 has been used for all vessels, this being assumed to be an appropriate coefficient for the ratio. The speeds given by the speed-length ratio adopted are sufficiently high for all practical purposes with present costs of fuel.

Horsepower.—The shaft horsepowers have been calculated on the basis of maintaining at sea in any ordinary weather the speeds given. A propulsive coefficient of 0.60 has been used and a margin of power allowed.

Deadweight.—The total deadweight has been taken as a percentage of the load displacement, the figures used in each case are those shown on curve, Fig. 2, which is based on vessels actually built.

Passenger Capacities, Rates and Performances.—The passenger capacities for each vessel are those given by the curve, Fig. 3, which is based on representative vessels. The minimum rates used are those which in all probability would be estab-

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†Naval architect, United States Lines, New York.

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lished by the Atlantic Passenger Conference, the body controlling this feature. The average first-class summer rates have been found to exceed the minimum summer rates by 20 percent, and this figure has been used; all other passenger revenues have been based on minimum rates. The summer season for first-class rates begins eastbound with sailings April 1 to July 31 inclusive, and westbound with sailings

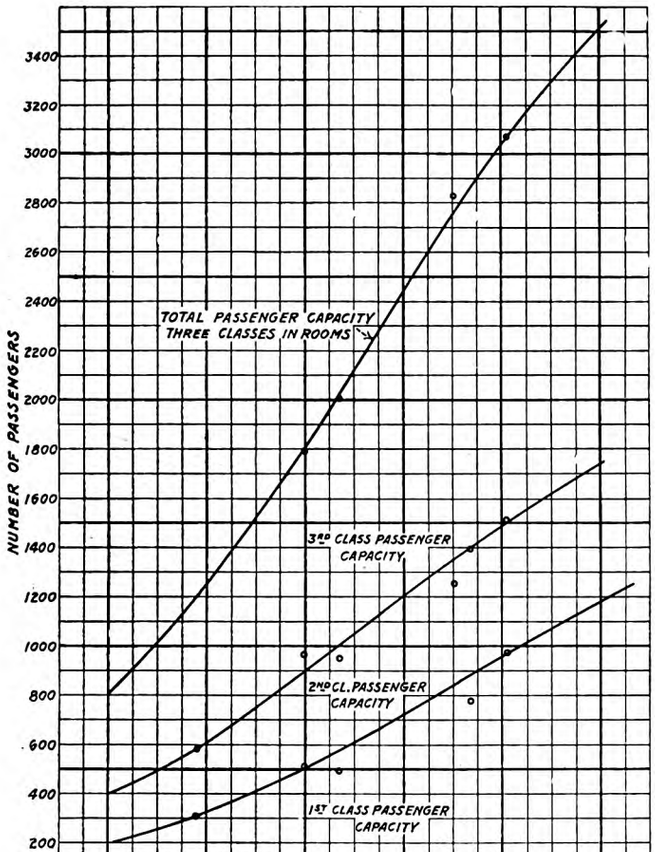
NUMBER OF PASSENGERS
TOTAL PASSENGER CAPACITY THREE CLASSES IN ROOMS
3RD CLASS PASSENGER CAPACITY
2ND CL. PASSENGER CAPACITY
1ST CLASS PASSENGER CAPACITY
LENGTH OF SHIP

Fig. 3

July 1 to October 31 inclusive, the remainder of the year being designated winter season with reduced first-class rates.

The passenger performances expressed on the basis of percentage of capacity for each class plotted against length are illustrated in curves, Fig. 4, which have been prepared from the 1922 carrying results of a large number of representative vessels.

Crew.—Perhaps in no other phase of the operation of large liners does the personal equation play so large a factor as in the determination of what constitutes an adequate crew for a particular vessel. In this analysis the crew for each vessel has been determined separately, on a directly comparative basis by departments; the deck department complement varying with the size of the vessel, the engine department with the horsepower, and the stewards' department, cooks, etc., with the passenger capacities. The United States Shipping Board scale of wages has been used with allowances made for crew costs during the annual lay-up period.

Service and Port Detention.—For the purpose of these notes the vessels have been assumed to be on the New York, Plymouth, Cherbourg, Bremen run returning New York via Southampton and Cherbourg; in round figures a distance of 3,700 nautical miles each way. In estimating time at sea between terminals, an allowance of two hours has been made for each port of call. The port detention has been taken as 70 percent of time at sea. All figures are based on 334 days' service time and one month off (January) for annual overhaul.

Invested Capital.—The invested capital given in each case can only be considered as an approximate estimate of the cost to build in American shipyards and fully equip ready for sea, under present conditions, vessels suitable for the highest class and most exacting of passenger services. Curve 1, Fig. 5, illustrating invested capital plotted against length, is partly based on certain recent estimates made by representative American yards. However, the figures used may be considered sufficiently indicative of actual costs for a comparative analysis.

Freight and Mail Revenue.—Cargo revenue has been figured at a rate of $10 per ton on the basis of 90 percent of capacity carried eastward and 40 percent westward. In the case of the 1,000-footer having a very limited cargo dead-

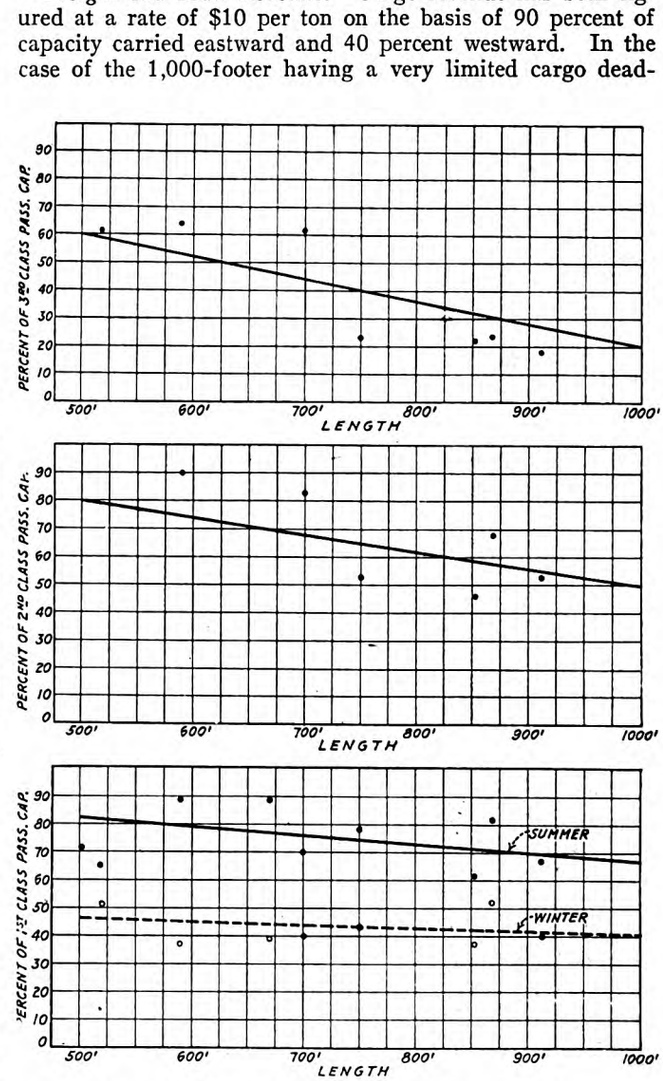

Fig. 4.—Passenger Carrying Performances

weight, the 90 percent factor of the available capacity each way has been used.

Mail revenue has been determined on the basis of 3,000 sacks eastward for the 500 and 550-footers and 6,000 sacks eastward for the remaining vessels. No mail revenue allowance has been made for the westward trips for the reason that mail in this direction is usually carried on vessels flying the flag of the country from which the mail emanates. Eastward mails carried without special contract are customarily conveyed at a rate of 80 cents a pound for letters and postcards and 8 cents a pound for other articles. It has been

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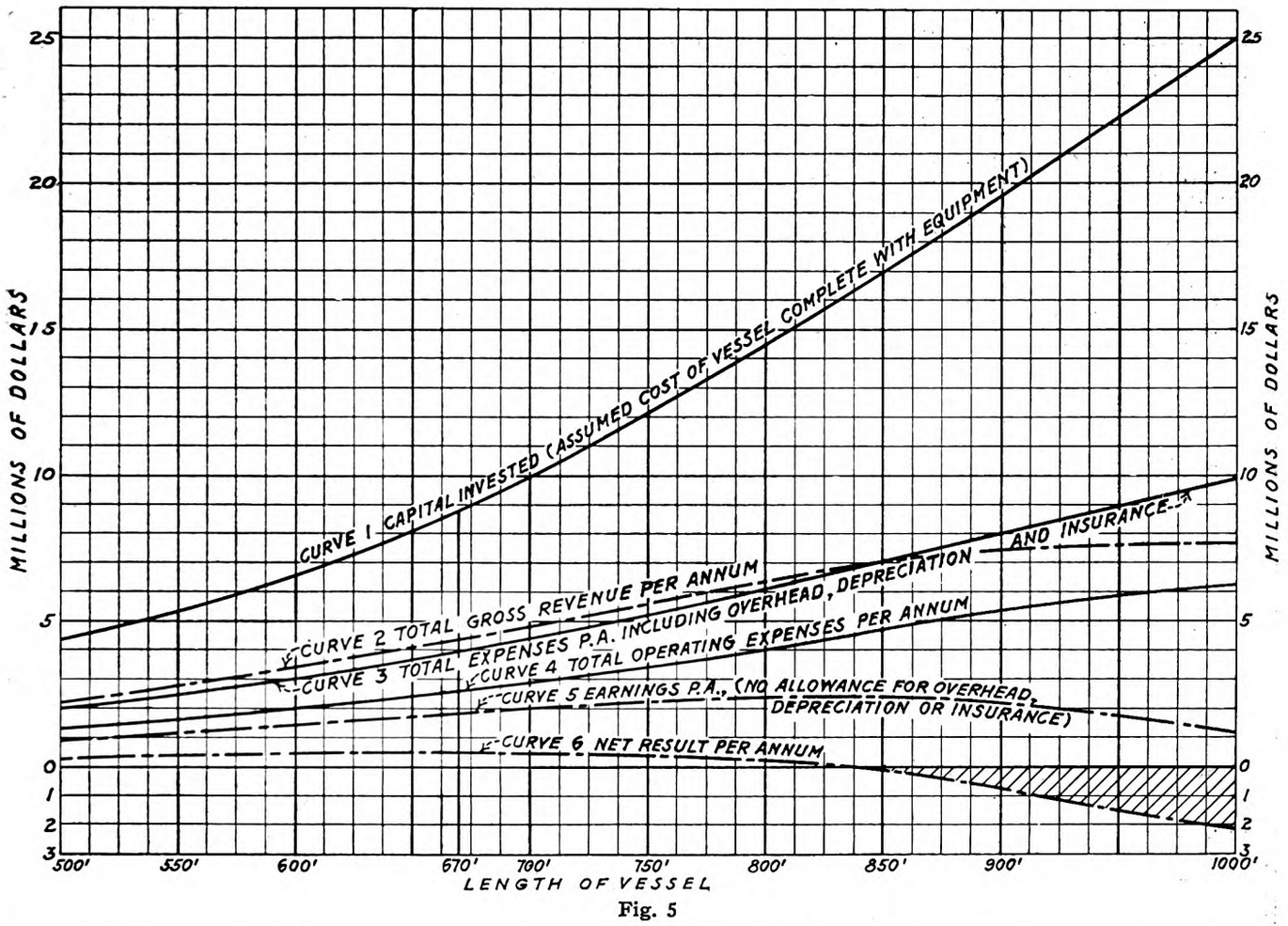
MILLIONS OF DOLLARS
CURVE 1 CAPITAL INVESTED (ASSUMED COST OF VESSEL COMPLETE WITH EQUIPMENT)
CURVE 2 TOTAL GROSS REVENUE PER ANNUM
CURVE 3 TOTAL EXPENSES P.A. INCLUDING OVERHEAD, DEPRECIATION AND INSURANCE
CURVE 4 TOTAL OPERATING EXPENSES PER ANNUM
CURVE 5 EARNINGS P.A., (NO ALLOWANCE FOR OVERHEAD, DEPRECIATION OR INSURANCE)
CURVE 6 NET RESULT PER ANNUM
500' 550' 600' 670' 700' 750' 800' 850' 900' 1000'
LENGTH OF VESSEL

Fig. 5

found that at these rates the revenue per sack will approximate $5, this factor being used in the analysis.

Fuel.—Oil fuel consumed has been estimated at 1.1 pounds per horsepower hour with due allowance for port consumption. Cost of fuel oil delivered at New York is $10.80 per ton, at Bremen $14 per ton, so the average cost of $12.40 was taken in the fuel cost calculation.

Of course, with the smaller vessels having the available

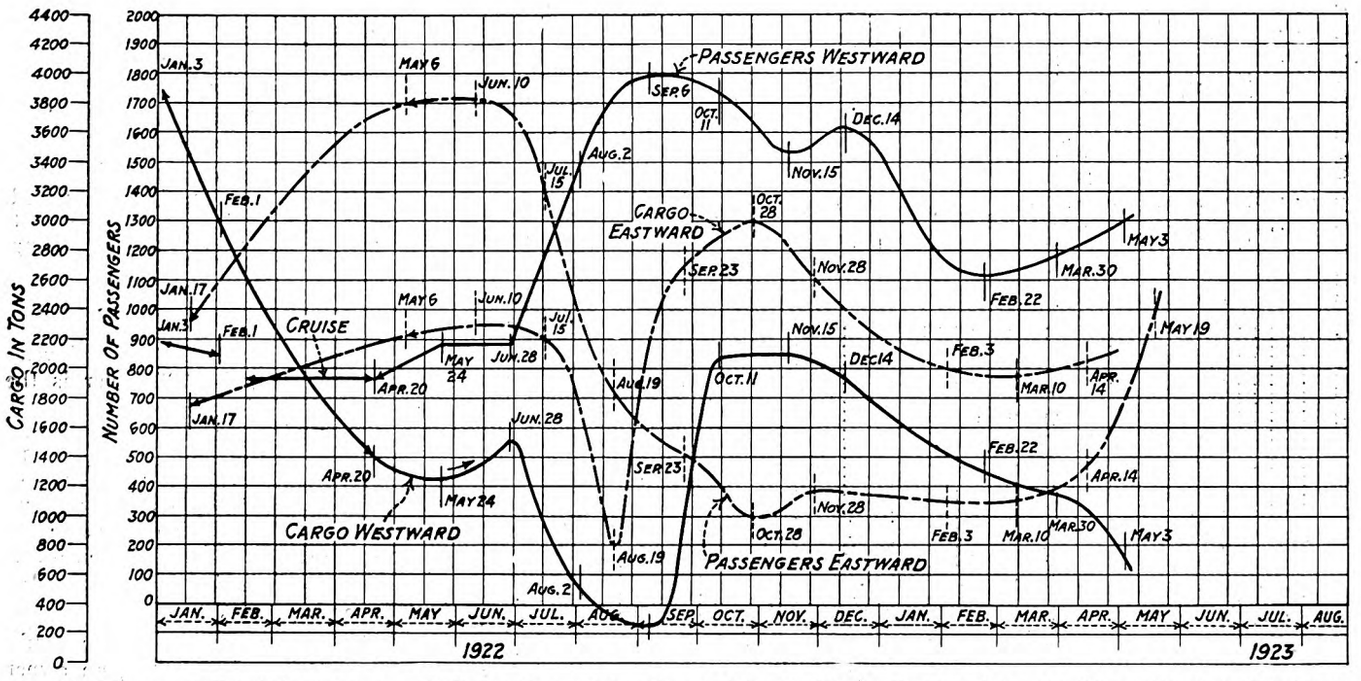

Fig. 6.—Curves of Total Passengers and Cargo Carried by North Atlantic Liner; Length Between Perpendiculars, 700 Feet; Beam, 78 Feet; Depth, 54 Feet; Draft, 33 Feet; Speed, 17 Knots

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TABLE I.—PARTICULARS OF VARIOUS TRANSATLANTIC LINERS, WITH ANNUAL REVENUE, EXPENDITURES AND RESULTS

	Particulars:										
1	Length	500'	550'	600'	670'	700'	750'	800'	850'	900'	1,000'
2	Breadth	67'	71'	75'	81'	83.5'	87.5'	92'	96'	100'	105'
3	Draft (loaded)	26.8'	28.4'	30'	32.4'	33.4'	35'	36.8'	38.4'	40'	42'
4	Block coefficient	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68
5	Displacement (tons)	17,443	21,546	26,228	34,162	37,928	44,625	52,621	60,878	69,942	85,680
6	Speed length ratio	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
7	Speed (knots)	16.77	17.59	18.37	19.41	19.84	20.54	21.21	21.86	22.5	23.71
8	Shaft horsepower	13,200	17,100	21,700	29,900	33,900	41,400	50,400	60,100	70,900	91,700
9	Deadweight total (tons)	7,850	8,840	9,970	11,610	12,140	13,160	14,210	15,220	15,740	15,420
10	Fuel capacity (one way + 20%), tons	1,849	2,283	2,783	3,628	4,099	4,751	5,600	6,490	7,446	9,150
11	Fresh water capacity (one way + 25%), tons	1,484	1,784	2,076	2,632	2,905	3,207	3,515	3,893	4,162	4,529
12	Passenger, crew, baggage and stores, wt. tons	277	346	421	554	612	718	836	955	1,076	1,285
13	Available cargo deadweight (tons)	4,240	4,427	4,690	4,796	4,524	4,484	4,259	3,882	3,056	456
		Capacity Min. Summer Min. Winter									
14	First class passenger capacity and rates	260 $209 $190	260 $220 $200	320 $231 $210	440 $242 $220	510 $242 $220	600 $264 $240	720 $264 $240	840 $275 $250	960 $275 $250	1,180 $275 $250
		Capacity Min. Rate									
15	Second class passenger capacity and rates	200 $125	230 $127.50	270 $130	370 $132.50	390 $132.50	450 $135	480 $135	500 $140	530 $140	560 $140
		Capacity Min. Rate (Av.)									
16	Third class passenger capacity and rates	400 $103	530 $103.00	660 $103	830 $103	900 $103.00	1,070 $103	1,240 $103	1,420 $103	1,550 $103	1,780 $103
17	Crew, number	264	331	404	530	583	689	801	914	1,025	1,234
18	Time at sea each voyage (days)	18.70	17.84	17.12	16.20	16.14	15.32	14.84	14.42	14.02	13.32
19	Time in port each voyage (days)	13.08	12.48	12.00	11.34	11.30	10.72	10.38	10.10	9.80	9.32
20	Number of trips per year (of 334 days)	10.51	11.01	11.47	12.12	12.17	12.82	13.24	13.62	14.02	14.75
21	Invested capital =	$4,400,000	$5,400,000	$6,600,000	$8,800,000	$10,000,000	$12,100,000	$14,400,000	$16,900,000	$19,600,000	$25,000,000
	Revenue:										
22	Passenger, first class	$556,639	$775,132	$1,012,394	$1,534,589	$1,770,337	$2,296,281	$2,889,630	$3,488,688	$4,036,032	$5,010,044
23	Passenger, second class	420,400	497,668	595,843	831,856	855,233	1,012,159	1,063,860	1,125,012	1,165,118	1,156,400
24	Passenger, third class	519,614	673,771	810,919	953,247	992,779	1,130,313	1,217,529	1,274,919	1,254,474	1,081,706
25	Freight	589,690	634,640	711,750	758,520	719,580	751,330	738,160	694,720	557,280	85,290
26	Mail	165,000	165,600	360,000	367,200	370,200	390,000	404,400	420,000	421,200	450,000
27	Total revenue =	$2,251,343	$2,746,811	$3,490,906	$4,445,412	$4,708,179	$5,580,383	$6,313,579	$7,003,339	$7,434,104	$7,783,440
	Expenses:										
28	Fuel	$406,732	$526,182	$668,137	$920,278	$1,043,882	$1,274,621	$1,551,624	$1,850,328	$2,184,706	$2,824,484
29	Wages and salaries of crew	227,700	280,294	357,742	477,848	529,656	633,880	746,132	861,902	9 8,363	1,206,235
30	Subsistence, passengers and crew	207,115	252,865	298,421	381,008	414,217	469,637	530,302	579,208	626,457	690,981
31	Repairs and ship and engine supplies	220,000	270,000	330,000	440,000	500,000	605,000	720,000	845,000	980,000	1,250,000
32	Towage, pilotage, whf'ge, dockage, port dues	45,088	56,713	70,645	94,094	103,933	127,050	152,814	189,159	210,673	269,603
33	Laundry	13,270	15,988	18,506	22,675	24,155	26,651	28,993	30,424	31,436	31,161
34	Freight handling, mail and baggage expense	202,615	218,396	252,369	269,819	257,879	270,486	268,101	255,567	211,761	60,143
35	Total operating expense	$1,322,520	$1,620,438	$1,995,820	$2,605,722	$2,873,722	$3,407,325	$3,997,966	$4,602,288	$5,223,396	$6,332,607
36	Overhead-administrative, advertising, etc.	330,630	405,110	498,955	651,430	718,430	851,831	999,491	1,150,647	1,305,849	1,583,152
37	Depreciation and insurance	352,000	432,000	528,000	704,000	800,000	968,000	1,152,000	1,352,000	1,568,000	2,000,000
38	Grand Total expenses	$2,005,150	$2,457,548	$3,022,775	$3,961,152	$4,392,152	$5,227,156	$6,149,457	$7,105,235	$8,097,245	$9,915,759
	Results:										
39	Net result per annum	$246,193	$289,263	$468,131	$484,260	$316,027	$353,227	$164,122	Loss $101,896	Loss $663,141	Loss $2,132,319
41	Cost of operations P.A./$1,000,000 invested	300,573	300,081	302,406	296,105	287,372	281,597	277,636	272,342	266,499	253,304
42	Result per annum per $1,000,000 invested	55,953	53,567	70,929	55,029	31,603	29,192	11,397	Loss 6,029	Loss 33,834	Loss 85,292

deadweight, in view of the high cost of fuel relative to freight rates, it may be an advantage to carry round-trip fuel. In this comparison, however, all vessels are dealt with similarly carrying but one-way fuel plus an adequate reserve.

Subsistence. — Subsistence costs have been figured at the standard Shipping Board allowance of $0.65 per man in crew per day and separate rates per passenger per day for each of the first, second and third classes.

Repairs and Supplies.—These have been taken at 5 percent per annum of the invested capital.

Towage, Pilotage, Wharfage, Dockage, and Port Dues.—Wharfage and dockage have been calculated for each vessel for the time in port. A cost factor, towage, pilotage and port dues expressed on a displacement tonnage basis was obtained from these costs of similar vessels in the same service and used.

Freight Handling and Mail and Baggage Expense.—This expense is, of course, proportionate to the quantity handled, factors from actual costs having been used.

Overhead.—Overhead — administrative, advertising, etc. — has been taken at 25 percent per annum of total operating costs.

Depreciation and Insurance.—Depreciation has been charged and insurance costs taken at 8 percent per annum of the capital invested.

Results.—Particulars of vessels, revenues, expenditures and results are given in Table I.

As a matter of interest in order that those unacquainted with the North Atlantic Service may realize the large variations, due in part to the season, in cargo and especially the passenger trades, there is given in Fig. 6, curves of total passengers and cargo performances both eastward and westward for a well-known vessel from January, 1922, until May, 1923.

Conclusion

For the greatest return on investment today, the **600-footer is the** logical choice, a vessel of this length giving about 7 percent per annum return on investment. In this connection, it is interesting to recall and comment upon the wisdom of the Cunard Line in adopting this length for the majority of their post-war-built fleet of vessels.

If a return on investment of about 3 percent per annum would be considered sufficient, **an owner** would be justified in designing, building and operating a vessel of

750 feet in length; the construction and operation of any vessel having a length exceeding this cannot be justified from an American private owner's point of view under existing conditions. A European owner, however, with lower construction, equipment and operation costs, but with the same gross revenue, having in mind only a 3 percent return, could, of course, somewhat exceed this length; but for maximum return on investment the results would be analogous to the American comparison.

There are very few trips a year when the 900- or 1,000-footerrs will approach capacity in passenger-carrying performances, and during the remainder of the year these vessels will not carry any more passengers than, say, the 600- or 700-footers, the passenger traffic being so seasonal and the capital invested in lengthier vessels so increasingly large that these factors in themselves should indicate the economics of the very large vessels in comparison with more moderately sized ones. It may, therefore, be said that world conditions will have to very materially improve before the 1,000-footer is an economic probability for either a European or American company, although less so for the European.

Fig. 5, in addition to indicating the assumed invested capital, shows the results in Table I in graphical form. It is interesting to note that the items which render the very large vessel financially inefficient are insurance and depreciation, or those items dependent upon the capital invested, as well as the fact that the proportion of actual traffic to capacity is less in the larger vessel than in the vessel of more moderate dimensions. The present exceptionally high first costs are in part the deterrent to the building of large vessels.

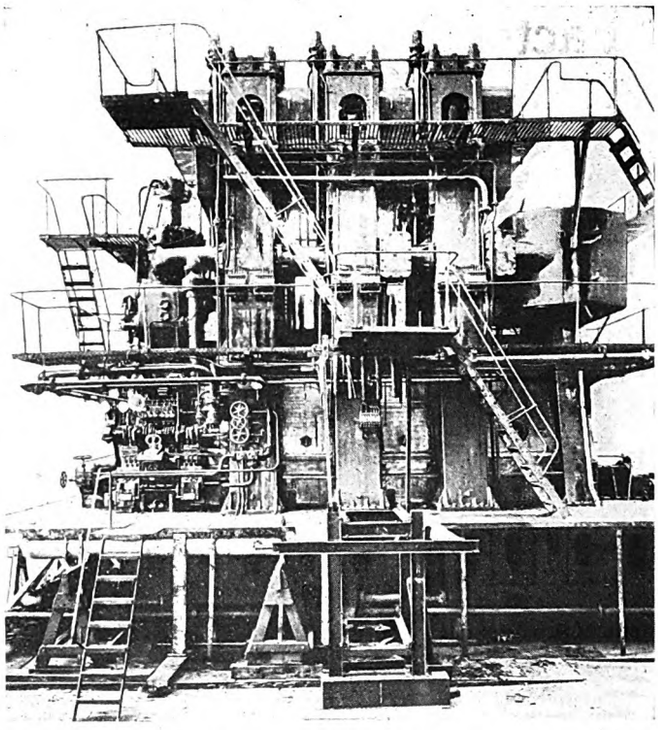
North British 2,000 Horsepower Double-Acting Diesel Engine

By Our Special London Correspondent

A CERTAIN amount of preliminary information has already been published concerning the new type of double-acting two-cycle engine which the North British Diesel Engine Works has developed. The 2,000 brake horsepower two-cycle set which this firm is constructing for installation in a 5,000-ton cargo ship is now completed, and some details of the results achieved are of special importance in view of the fact that a great saving in weight and space has been effected by the adoption of this principle of operation.

As will be seen from the illustration, the engine has three cylinders, the dimensions being 24½ inches bore and 44 inches stroke; the rated power given above is developed at 100 revolutions per minute. The length of this engine overall is only 30 feet, including the crankshaft driven scavenging pump and the air compressor. The height is approximately the same and the width over the bedplate is scarcely more than 10 feet. Perhaps the most important fact of all, however, is that the weight is only about 200 tons, whereas it is considered that an average four-cycle single-acting engine would weigh about 360 tons to develop equal power at the same speed.

On the left can be seen the control gear which is all hand-operated, the fuel pumps being driven by a mechanism on the sliding cylinder itself. The camshaft is thus eliminated with the idea of simplifying the design. Exactly the same principle of operation has been employed as in the experimental engine which was built before constructing this large set. The cylinder has a sliding motion and, in its movement in relation to the piston, uncovers the exhaust and scavenging ports at the correct times. The cylinder slides over the top and bottom covers, a distance of some 12 or 15 inches, and the gudgeon pin is brought out through slots in the cylinder, allowing the drive to be taken on to the crankshaft through a forked connecting rod. The cylinders themselves are driven from the main crosshead pins and although the employment of sliding cylinders may seem to be somewhat surprising, it is claimed that no difficulties are likely to be encountered from this construction.



New 2,000 Brake Horsepower, Double Acting, Two Cycle North British Diesel Engine

It is not to be expected that the fuel consumption of an engine of this class will be equal to that of a four-cycle single-acting motor. It was found on the preliminary trials that the figure attained was about 0.45 pound per brake horsepower hour, this being some 12 or 13 percent higher than with the modern Burmeister & Wain four-cycle single-acting type. It is possible, however, that improved results will be achieved with further experiments, and in any case the saving in weight and space—and presumably cost—is so important as to give the engine a wide field of application, should it prove thoroughly reliable in service.

Army Launches First All-Electric Dredges

TWO all-electric dredges, the *A. Mackenzie* and the *W. L. Marshall,* were launched on November 20 at the yards of the Sun Shipbuilding and Dry Dock Company, Chester, Pa. These dredges, which were built for harbor service by the Engineer Corps of the United States Army and equipped electrically by the Westinghouse Company, are the first all-electric vessels of this type ever built.

Two more dredges of the same type, the *Dan C. Kingman* and *Wm. T. Rossell,* will be launched at the Sun yards in the near future. On completion the *A. Mackenzie* will be assigned to Mobile Bay, the *W. L. Marshall* to the north Atlantic Coast, the *Dan C. Kingman* to the south Atlantic Coast, and the *Wm. T. Rossell* to Coos Bay.

Every detail of these dredges has been designed by the Engineer Corps. Electricity is used for every possible purpose, including propulsion, the operation of all auxiliary machinery, cooking, heating and lighting. Oil engines generate the necessary power; and the movements of the ships are controlled directly from the pilot house.

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Factors Affecting the Economy of Lake Freighters*

Trade Conditions on the Great Lakes—Size and Speed of Vessels—Detention in Port—Influence of Nature of Cargo on Earnings—Operating Expenses.

By Professor Anders F. Lindblad†.

IT is well known that the transportation and handling of cargo in bulk is done on the Great Lakes at a very cheap rate. In fact, it is probably done more economically in this district than anywhere else in the world.

During the last few years there have not been any fundamental changes in the construction of the lake freighters. The vessels do not carry any machinery for handling of the cargo. The necessity for a quick dispatch has led to the installation on the docks of both loading and unloading machinery, which in turn is specially designed to suit each kind of cargo. It is largely due to the remarkable efficiency

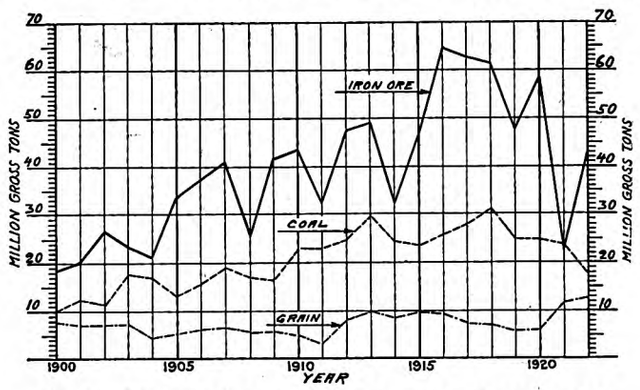

Fig. 1.—Bulk Freight Movement on the Great Lakes

of this machinery that the bulk cargoes on the Great Lakes are handled with such an unusual speed and at such a low cost. The nature of this machinery has had such a great influence on the structural details of the ships that we may say that the design has been worked out mainly to suit the loading and unloading machinery.

The increase in size of the vessels has been most remarkable. In 1886 the largest ship was 303 feet long; in 1898 two vessels were built which were 455 feet long with 50 feet beam and a depth of 29 feet. The largest ships now on the lakes are *W. Grant Morden,* 625 feet overall length, 59 feet beam and 33 feet depth with a deadweight capacity of 14,200 gross tons; and the steamers *Col. J. M. Schoonmaker* and *Wm. P. Schneider, Jr.,* 617 feet overall, 64 feet beam and 33 feet depth, deadweight capacity 14,000. The majority of the newer ships have the following dimensions: Length on keel, 580 feet; breadth molded 60 feet, and 32 feet depth; deadweight capacity about 12,100 gross tons at draft of 20 feet.

While the length of the vessels has been gradually increased, the beam and the molded depth have not been increased in the same proportions. The beam has, to a certain extent, been limited by considerations of locks, narrow channels, etc., and by the reach of the unloading machinery. The draft is limited by the depth of water at the locks at Sault Sainte Marie and in the channels connecting the lakes. The available draft is at present about 20 feet. An increase in the displacement has been possible only by increasing the length and by adopting a very full block coefficient; as a rule the block coefficient is 0.87 to 0.88. The depth of the vessels has been governed mainly by the height of the ore docks. In order to get sufficient slope on the ore spouts the vessel must not, when light, be too high out of the water. A molded depth of 32 feet to 33 feet has been adopted on the largest of the freighters.

General Conditions of the Lake Trade

Bulk cargoes of iron ore, coal and grain form the main part of the trade on the Great Lakes. A large amount of stone, lumber, and general cargo is also carried, but such cargoes are usually transported by vessels of other types than the typical bulk freighters.

Nearly all the iron ore and the grain are shipped eastward from the ports on Lake Superior to the lower lakes, most of it to the Lake Erie ports. The movement of coal is in the opposite direction from the ports on Lake Erie to the head of the lakes.

Fig. 1 gives a summary of the trade from 1900 on. It shows that the amount of iron ore and grain transported is, in general, two to three times as much as that of the coal. This, obviously, means that the vessels on the westward journeys can secure cargoes for only about one-half to one-third of the number of trips. The remainder of these westward trips therefore have to be made without any cargo in the light or ballasted condition. Every shipowner, of course, wishes to get as many as possible of the available coal cargoes for his ships so as to avoid running them up the lakes without any paying cargo. There is therefore always a very keen competition in getting the contracts for moving the coal, which

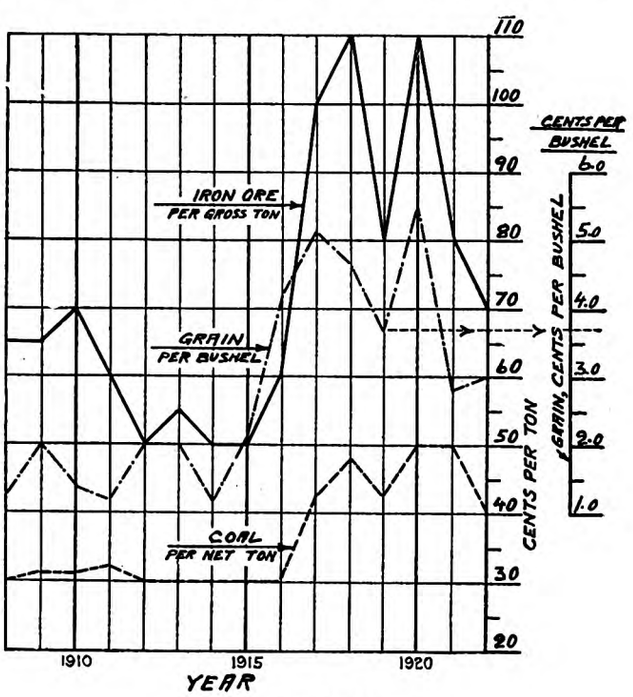

Fig. 2.—Freight Rates

*Paper read before the Society of Naval Architects and Marine Engineers, New York, November, 1923. The investigations in this paper were started in the summer of 1922, and the costs of the vessels are estimated as of that date. Since then there has been an increase of from 20 percent to 30 percent. This, however, does not have any material effect on the comparative results.

†Assistant professor of naval architecture, University of Michigan, Ann Arbor, Mich.

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naturally tends to lower the rate on this commodity. Owing to this condition the coal is generally transported at a rate of not more than about a half of the rate for iron ore.

The shipment of grain on the Great Lakes during the last few years has increased enormously, and is a very important factor in the operation of the lake freighters. Most of the grain is moved either late in the season, after the harvest, or otherwise early in the spring. While the rate on iron ore

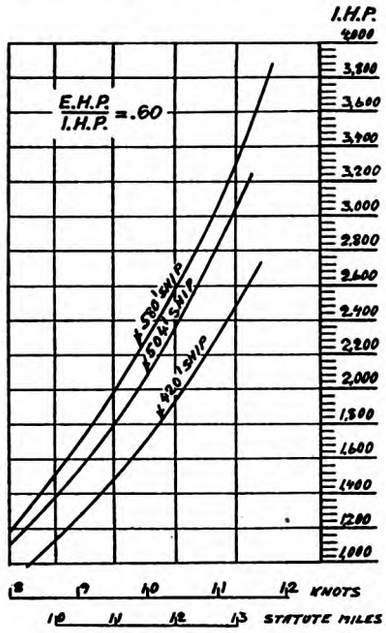

Fig. 3.—Horsepower Curves

Length	Beam	Draft	Displacement Tons at 2,240 lbs.	Block-Coefficient
580′-0″	60′-0″	20′-0″	16,950	.8768
504′-0″	56′-0″	20′-0″	13,717	.8747
420′-0″	52′-0″	20′-0″	10,192	.840

and coal practically does not change during a sailing season, the grain rate fluctuates surprisingly from day to day. It is not uncommon that the amount of profit for the whole season largely depends on the rates which have been obtained for the last few trips with grain toward the closing of the navigation. There is always an uncertainty concerning the length of the sailing season, which is mainly governed by the weather conditions. The formation of ice, for example, may cause an early closing of navigation. This also has a great influence in making the grain rate changeable and subject to speculation.

Fig. 2 gives the rates obtained for the different kinds of cargoes. If we neglect the peak during the war years, it appears that the freight rates are slowly increasing.

As iron ore, coal and grain are some of the most important commodities of the American nation, it is to be expected that the rates for transporting them on the Great Lakes would, as a rule, follow the upward or downward trend, as the case may be, of the general economic conditions of the country. Lake transportation is so closely connected with the iron and steel industry that the condition of this industry is really the determining factor in the fixing of the freight rate on iron ore. It is also well known that the United States Steel Corporation, for example, through its control of the largest fleet of lake freighters, Pittsburgh Steamship Company, has a very decided influence in this respect.

ASSUMPTIONS

In order to make a systematic analysis of the various factors affecting the economy of the lake freighters it has been necessary to make a considerable number of assumptions, and these will be discussed in the following paragraphs. To some extent I have followed the method used by Mr. Alfred J. C. Robertson in his interesting paper "Economical Cargo Ships."*

DIMENSIONS

For calculations three typical vessels were chosen with the following particulars:

Length	Beam	Depth	Displacement at 20′ draft	Block coefficient
580′	60′	32′	16,950 long tons	0.876
504′	56′	30′	13,717 long tons	0.874
420′	52′	28′	10,192 long tons	0.840

The load draft was in all cases taken as 20 feet, which at present seems to be a fair average; although frequently some trips may be run at a deeper draft, when the water levels on the lakes so permit.

WEIGHTS

From a comparison of several of the present lake freighters the following hull weights (steel, wood and outfit) were obtained:

580 foot vessel, 4,287 long tons
504 foot vessel, 3,300 long tons
420 foot vessel, 2,426 long tons

The weight of the machinery was assumed to vary directly with the horsepower, and the weight in tons was taken as I. H. P.

4.7

SPEED AND POWER

Calculations were made for speeds of 10, 11, 12 and 13 statute miles per hour. The horsepower needed at the different speeds was estimated from some curves of results obtained from models of similar vessels, which have been tested in the University of Michigan tank. Fig. 3 shows the horsepower curves, and Table I gives the indicated horsepower as scaled off at the different speeds.

A propulsive coefficient of 0.60 was assumed, a value which experience seems to indicate is easily reached on these very full vessels. In fact, some of the published results do not agree with the tank results unless a higher propulsive coefficient is assumed.† The naval architects on the Great Lakes often figure with a propulsive coefficient of 0.65.

COST OF VESSELS

Table I gives the cost of the vessels as used in my calculations. The costs of the hulls, steel, wood and outfit were taken to vary directly with the weights. The cost of machinery was estimated on the assumption that for a larger horsepower the cost would be smaller per indicated horse-

TABLE I—COST OF VESSELS

Vessel 580′ × 60′ × 32′				
Speed in miles	10	11	12	13
I. H. P.	1,500	1,970	2,580	3,300
Cost of machinery	$73,750	$95,315	$122,205	$152,350
Cost of hull	$677,795	$677,795	$677,795	$677,795
Total cost of ship	$751,545	$773,110	$800,000	$830,145
Vessel 504′ × 56′ × 30′				
Speed in miles	10	11	12	13
I. H. P.	1,380	1,800	2,340	3,045
Cost of machinery	$68,125	$87,600	$117,776	$141,855
Cost of hull	$521,730	$521,730	$521,730	$521,730
Total cost of ship	$589,855	$609,330	$633,506	$663,585
Vessel 420′ × 52′ × 28′				
Speed in miles	10	11	12	13
I. H. P.	1,130	1,490	1,940	2,445
Cost of machinery	$56,255	$73,285	$93,960	$116,360
Cost of hull	$383,550	$383,550	$383,550	$383,550
Total cost of ship	$439,805	$456,835	$477,510	$499,910

Costs of vessels are estimated as of 1922. Since then they have increased from 20 to 30 percent.

*See Transactions S. N. A. & M. E., 1919.

†Compare Professor Sadler's discussion of Admiral Taylor's paper, "Some Experiments on Propeller Position and Propulsive Efficiency," Transactions Society Naval Architects and Marine Engineers, 1922.

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TABLE II.—AVERAGE STAY IN PORT (FOR VESSELS BELONGING TO THE PITTSBURGH STEAMSHIP COMPANY)

	Year																	
	1912		1913		1914		1915		1916		1917		1918		1919		1920		1921		1922	
	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.
Average stay in lower lake ports	20	9	21	9	17	18	17	41	20	30	25	28	22	18	22	55	34	33	20	54	23	32
Average stay in upper lake ports	11	51	13	52	9	12	7	46	9	42	8	42	9	8	12	17	9	30	7	31	6	19
Average time spent in port receiving and discharging cargoes	32	..	35	1	26	30	25	27	30	12	34	10	31	26	35	12	44	3	28	25	29	51
	GROSS TONS																					
Average cargo carried	6,796		7,283		7,572		7,534		7,989		8,360		8,498		8,695		8,475		10,147		8,402	
Largest cargo carried	13,067		12,373		12,222		12,087		13,521		13,732		13,505		13,612		13,912		12,796		12,370	
Fastest loading record	10,325		5,897		10,613		8,179		11,379		12,032		12,655		8,529		12,237		12,382		11,007	
In hours and minutes	2:35		1:15		1:30		1:00		2:15		2:05		1:50		0:40		1:35		0:16½		1:35	
Rate of fastest loading record per hour	4,136		4,718		7,075		8,179		5,057		5,775		6,903		12,800		7,730		45,024		6,977	

*From "Annual Report Lake Carriers' Association," 1922.

TABLE III.—CALCULATIONS FOR CURVES IN FIG. 9

	580′ Vessel				504′ Vessel				420′ Vessel			
Speed in miles	10	11	12	13	10	11	12	13	10	11	12	13
Total number of trips	16	18	20	22	16	18	20	22	16	18	20	22
Cargo in tons (2,240 lbs.) Iron ore	12,270	12,154	11,906	11,831	10,054	9,931	9,820	9,668	7,469	7,381	7,271	7,151
Cargo in tons (2,240 lbs.) Coal	12,135	11,983	11,801	11,591	9,922	9,796	9,635	9,428	7,360	7,251	7,117	6,972
Income: 14, 16, 18, 20 trips with ore at 80 cents per ton	137,424	155,564	171,450	189,300	112,602	127,120	141,388	154,680	83,650	94,480	104,706	114,420
Income: Two trips with grain at 3 cents per bushel	27,480	27,224	26,688	26,500	22,520	22,244	21,996	21,656	16,730	16,553	16,286	16,018
Income: Five trips with coal at 45 cents per ton	27,300	26,964	26,550	26,080	22,320	22,040	21,675	21,210	16,560	16,320	15,885	15,685
Income: Total income	192,204	209,752	224,668	241,880	157,442	171,404	185,059	197,546	116,940	127,353	136,877	146,123
Outgo: Depreciation, Upkeep and repairs 7½%	90,185	92,773	96,000	99,617	70,783	73,120	76,021	79,630	52,777	54,820	57,301	59,989
Outgo: Insurance 4½%												
Outgo: Wages	31,737	33,875	33,875	33,875	30,112	30,112	32,250	32,250	30,112	30,112	32,250	32,250
Outgo: Coal at $6.00 per ton	19,776	26,201	34,560	45,010	17,913	23,654	31,078	40,682	14,722	19,590	25,776	32,736
Outgo: Stores (deck and engine)	6,000	6,000	6,000	6,000	5,000	5,000	5,000	5,000	4,000	4,000	4,000	4,000
Outgo: Meals	6,277	6,885	6,885	6,885	5,872	5,872	6,480	6,480	5,872	5,872	6,480	6,480
Outgo: Management	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Outgo: Total cost of operation	158,975	170,734	182,320	196,387	134,680	142,758	155,829	169,042	112,483	119,394	130,807	140,455
Total income	192,204	209,752	224,668	241,880	157,442	171,404	185,059	197,546	116,940	127,353	136,877	146,123
Total outgo	158,975	170,734	182,320	196,387	134,680	142,756	155,829	169,042	112,483	119,394	130,807	140,455
Profit in dollars	33,229	39,018	42,348	45,493	22,762	28,648	29,230	28,504	4,457	7,959	6,070	5,668
Profit in percent on the investment	4.42	5.05	5.29	5.48	3.86	4.70	4.62	4.30	1.01	1.74	1.27	1.13

power than for an engine of lower power. The price was taken to vary in direct proportion to the power from $45.00 per indicated horsepower for machinery of 4,000 indicated horsepower to $50.00 per indicated horsepower for machinery of 1,000 indicated horsepower.

The cost of hull and machinery was so chosen that with machinery for 12 miles speed the 580-foot would cost $800,000.

Time in Port and Number of Trips

The actual time required for loading and unloading is very short, and some remarkable records have been made, as shown in Table II. It is not uncommon that even a cargo of 10,000 to 12,000 tons of iron ore is loaded into a vessel in about three to four hours. Often, however, there are delays due to congestion at the docks, when several vessels are waiting for their turn. But such delays are, in general, not very long in the coal and ore traffic. When the vessels carry grain there is quite often a more serious loss of time, particularly in the discharging end at the Lake Erie ports, where the grain elevators in the last few years have been unable to handle the increasing traffic in a satisfactory way. Delays of several days and even weeks have been rather common at the closing days of the season.

Table II shows that for vessels which carry only coal and ore the average stay in port is about thirty hours per round trip. Shorter delays, such as waiting for their turn to be taken through the locks at Sault Sainte Marie and encountering fogs and storms, will also cut down to some extent the time the vessels are under way. There is not much difference between the time a larger vessel has to spend in port and that of a smaller. For my calculations I have assumed that a speed-difference of one mile per hour will make a difference of two round trips during the entire season. Fig. 4 shows that this is approximately correct.

Fuel Consumption

The coal consumed was computed at 1.7 pounds per indicated horsepower per hour. It was assumed that the coal consumption in port for every trip would be 16 tons for the 580-foot vessel, 12 tons for the 504-foot vessel, and 10 tons for the 420-foot vessel. Calculations were made for different prices of coal from $4 to $8 per ton.

Operating Expenses

All the operating expenses were figured on the basis of a season of 225 days. The wages for the crew were calculated from the wage scale of the Lake Carriers' Association, which was in effect during the season of 1922. The cost of meals was taken as 90 cents per man per day. The allowance for deck and engine stores was taken as $6,000 for the 580-foot

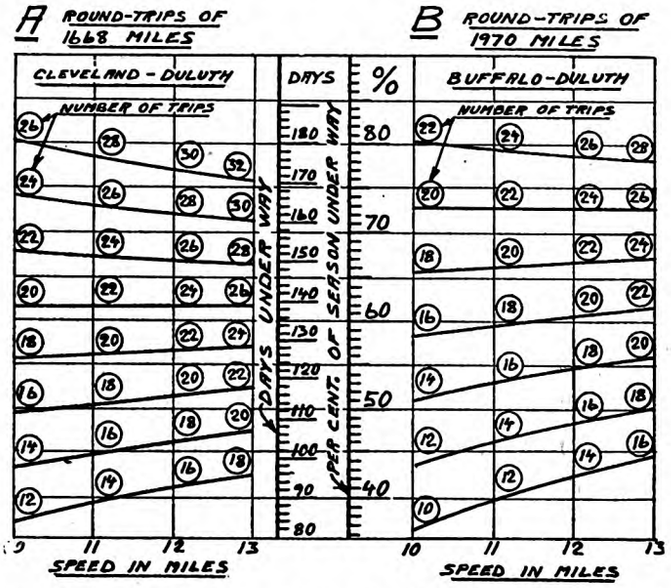

Fig. 4.—Number of Round Trips During a Season (Assumed to Be 225 Days) at Different Percentages of Time Under Way

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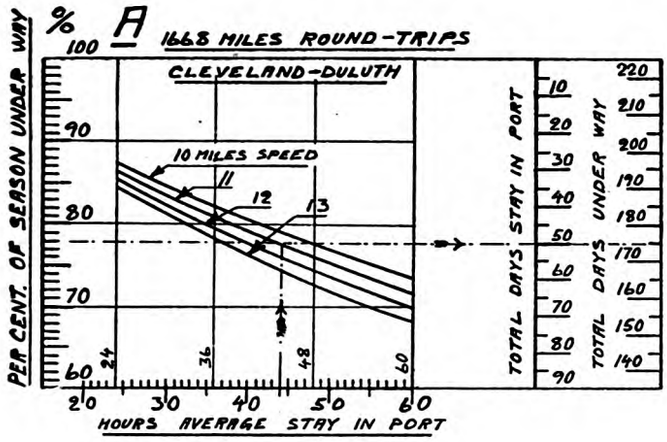

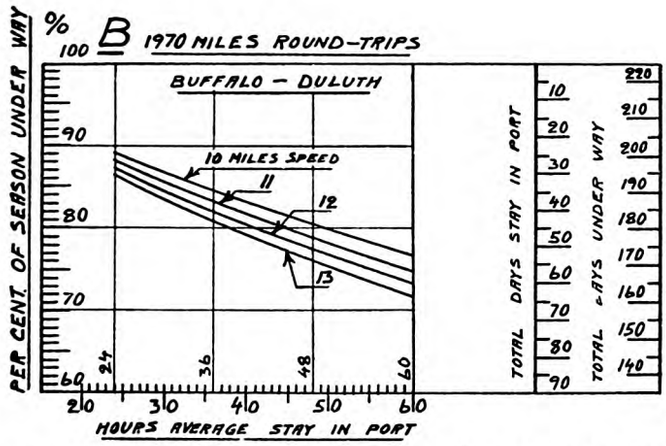

Fig. 5.—Time Under Way at Different Lengths of Stay in Port

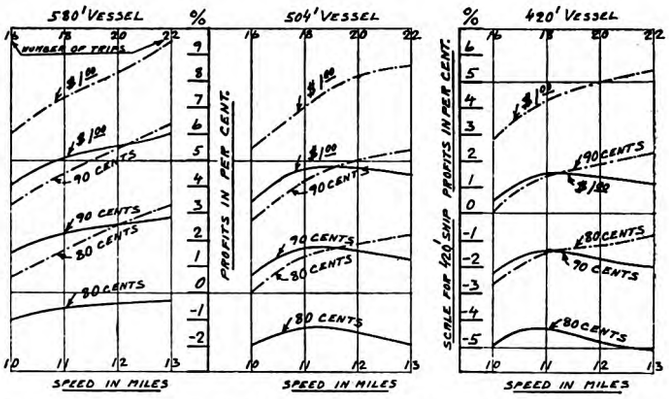

Fig. 7.—Effect of Different Rates on Iron Ore (No Coal or Grain Cargoes). Price for Bunker Coal per Ton, —.—.—44.00, —.—.—$8.00

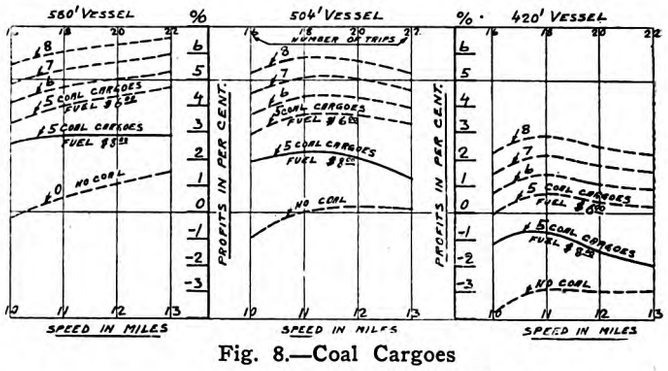

Fig. 8.—Coal Cargoes

Kind of Cargo and Rate	Number of Cargoes: Speed in Miles 10	11	12	13
Iron ore at 80 cents per ton.....	16	18	20	22
Coal at 45 cents per ton.....	As indicated above			

ship, $5,000 for the 504-foot and $4,000 for the 420-foot ship. For each ship an amount of $5,000 per season was added to cover management and overhead expenses.

The rate of insurance was taken as 4½ percent for the total season, and the vessels were assumed to be insured to their full value as given in Table I. The charge for depreciation, repairs, and upkeep has been figured at 7.5 percent per annum of the first cost of the ships. The policy

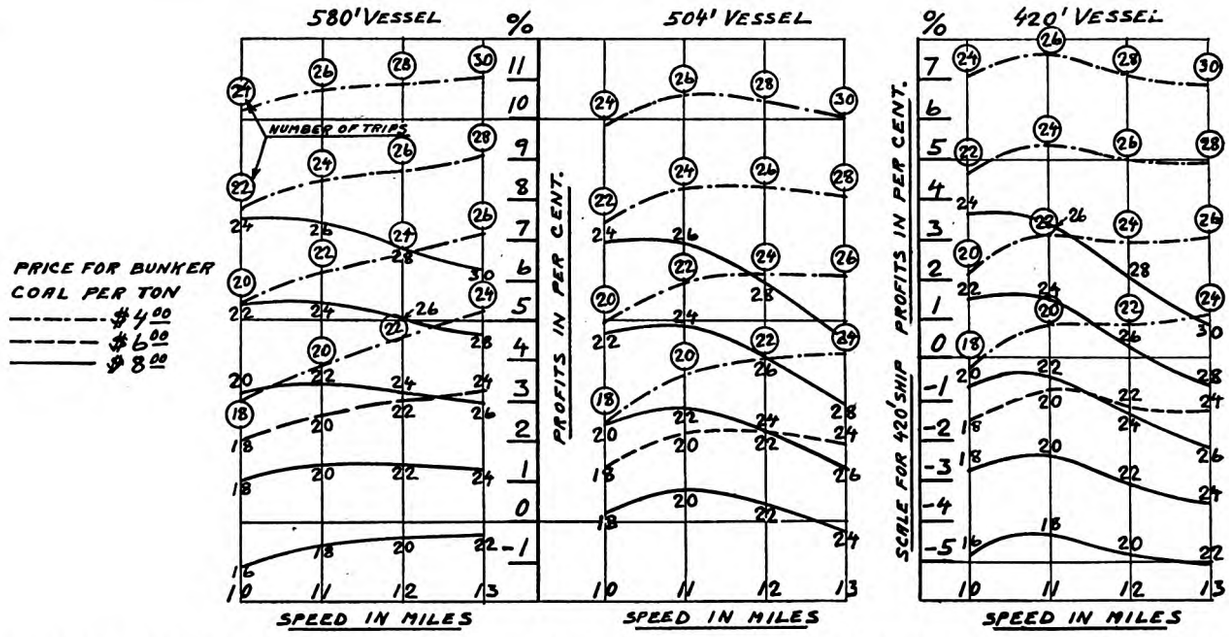

Fig. 6.—Effect of Different Number of Trips with Iron Ore (No Coal or Grain Cargoes). Ore Rate 80 Cents per Ton

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among shipowners on the lakes, however, is to be satisfied with a smaller percentage of depreciation.

In Fig. 13 the different items are shown as percentages of the total expenses, and Table III gives the corresponding figures in tabular form.

Discussion of the Results

The calculations show that the 420-foot ship has a very much lower earning capacity than a vessel of larger size with a length of 504 feet to 580 feet. All the smaller freighters on the Great Lakes are old, and they are built at a cost very much below the present prices. They have probably been written down to a small value in the books of the owners, and the depreciation and insurance charges can therefore be reduced to rather small amounts. For this reason they may still earn money when new vessels of the same dimensions would not be able to make any reasonable profits.

There is not much difference in earning capacity between the 504-foot and the 580-foot ship. The 580-foot ship shows slightly better results when the price is low for bunker coal. Figs. 11 and 12 indicate that a vessel of about 540 feet length in most conditions will be very nearly as economical as the 580-foot vessel.

Speed

From Fig. 6 it will be found that if a vessel with a speed of 11 miles an hour is not able to make two trips more during each season than a ship of 10 miles speed, then there will be a lower profit on the former vessel. The same is also true for a comparison between other speeds used in the calculations, say, for example, between a speed of 13 and 12 miles an hour. Figs. 4 and 5 indicate that, if the average detention in port is very long, it is not possible for vessels of higher speed to increase the number of trips sufficiently to meet the requirement that a speed difference of one mile an hour will make a difference of two trips during the season.

Detention in Port

Table II gives the average stay in port for vessels belonging to the Pittsburgh Steamship Company.* It shows that the delay in port has varied for these vessels from 25 hours and 27 minutes during the season of 1915 to 44 hours and 3 minutes during 1920—a difference of 18 hours and 36 minutes. From Fig. 5 it will be seen that this means that the vessels in the latter case had to spend in port from 7 to 9 percent more of the total time of the whole season; in other words, the steaming time was reduced by this amount. Fig. 4 indicates that such a reduction would cut down the number of possible trips during one season to from two to four trips, depending on the speed of the ship and the distance between the ports. A change of about 8 hours in the average stay in port will ,for a steamer of 11 miles speed, make a change of one trip in the total number of trips during a season.

It is evident from Fig. 6 that even a small decrease in the number of trips may seriously affect the financial result for the whole season. It is then clear that it is of uttermost importance for the lake freighters to keep the time in port down to a minimum.

*See page 183, Annual Report, Lake Carriers' Association, 1922.

KIND OF CARGO & RATE	NUMBER OF CARGOES SPEED IN MILES 10	11	12	13
IRON ORE @ 80 CENTS PER TON	14	16	18	20
COAL @ 45 CENTS PER TON	5	5	5	5
GRAIN @ CENTS PER BUSHEL	AS INDICATED BELOW			

BUNKER COAL $6.00

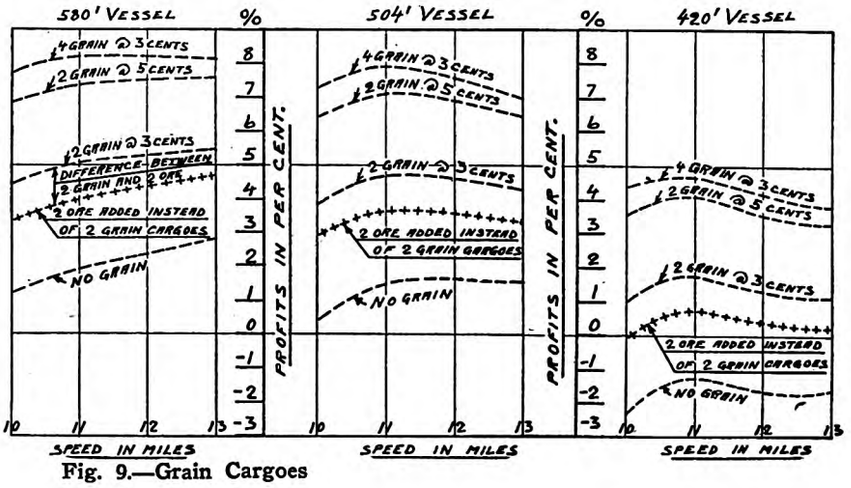
580' VESSEL
504' VESSEL
420' VESSEL
4 GRAIN @ 3 CENTS
2 GRAIN @ 5 CENTS
2 GRAIN @ 3 CENTS
DIFFERENCE BETWEEN 2 GRAIN AND 2 ORE
2 ORE ADDED INSTEAD OF 2 GRAIN CARGOES
NO GRAIN
PROFITS IN PER CENT.
SPEED IN MILES

Fig. 9.—Grain Cargoes

KIND OF CARGO & RATE	NUMBER OF CARGOES SPEED IN MILES 10	11	12	13
IRON ORE @ 80 CENTS PER TON	14	16	18	20
COAL @ 45 CENTS PER TON	5	5	5	5
GRAIN @ 3 CENTS PER BUSHEL	2	2	2	2

BUNKER COAL $6.00

A	AS IN CALCULATIONS
B	I.H.P. REDUCED BY 5%
C	WAGES INCREASED BY 10%
D	WAGES, MEALS, STORES & MANAGEMENT INCREASED BY 10%

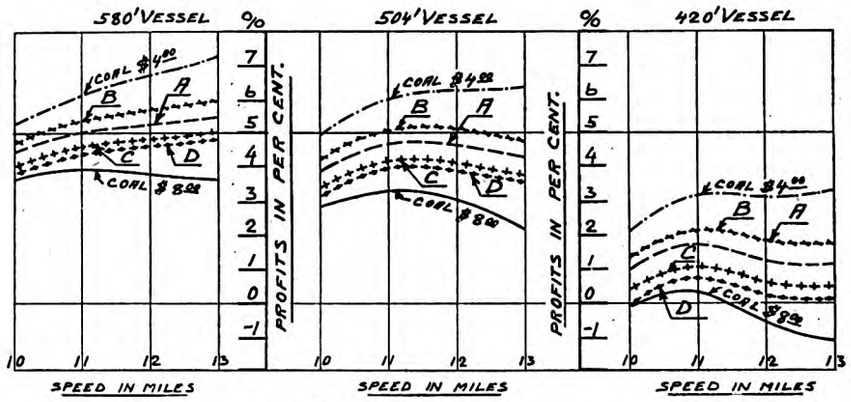

Fig. 10.—Changes in Cost of Operation

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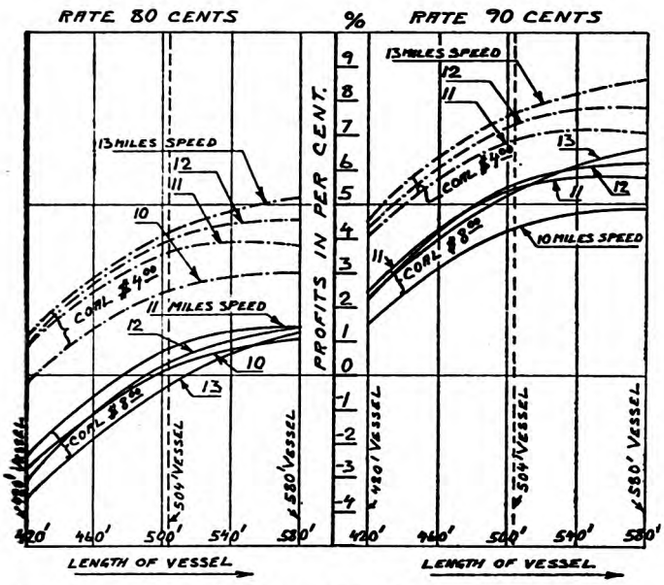

Fig. 11.—Iron Ore Cargoes (No Coal or Grain Carried)

Speed in miles	10	11	12	13
Number of cargoes	18	20	22	24

KINDS OF CARGOES

Iron Ore: The lake freighters always derive the main part of their income from the iron ore shipments. Fig. 6 shows how the profit will change with the numbers of the ore cargoes, and Fig. 7 indicates how different rates on iron ore will affect the earning capacity. See also Figs. 11 and 12.

Coal: As previously mentioned, it is not common that these vessels carry coal cargoes up to the head of the lakes on more than about one-half to one-third of the number of the westward trips. Fig. 8 shows that these coal cargoes are, however, of great importance to the economy of the vessels, in spite of the fact that the coal rate is, in general, only about half that of the ore rate. No extra expenses are incurred directly for them, because the ships must in any case go up to the ports on Lake Superior even if they cannot secure any cargoes for this part of the trips.

The loading and unloading of coal cargoes takes longer time than the handling of iron ore cargoes. There is thus always a considerable delay in the ports when the former kind of cargoes is carried, and this should be kept in mind when considering the relative merits between taking coal cargoes or going up the lakes in the light condition.

Grain: In Fig. 9 some diagrams are drawn showing how the grain cargoes will influence the earnings. If at the assumed conditions, as stated in the diagram, two cargoes of grain are carried instead of two ore cargoes, it will be seen that, at a rate of 3 cents a bushel, the grain cargoes will increase the profits for the whole season approximately 1 percent. Should a rate of 5 cents per bushel be obtained, the profits would be increased by about 2.9 to 3.6 percent.

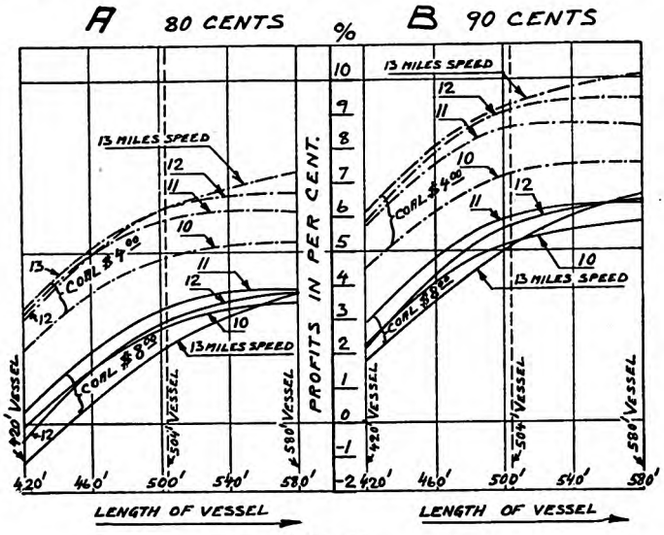

Fig. 12

Kind of Cargo and Rate	Number of Cargoes: Speed in Miles 10	11	12	13
Iron ore at A 80 cents per ton / B 90 cents per ton	14	16	18	20
Coal at 45 cents per ton	5	5	5	5
Grain at 3 cents per bushel	2	2	2	2
Price for bunker coal per ton — — —				$4.00
Price for bunker coal per ton ———				$8.00

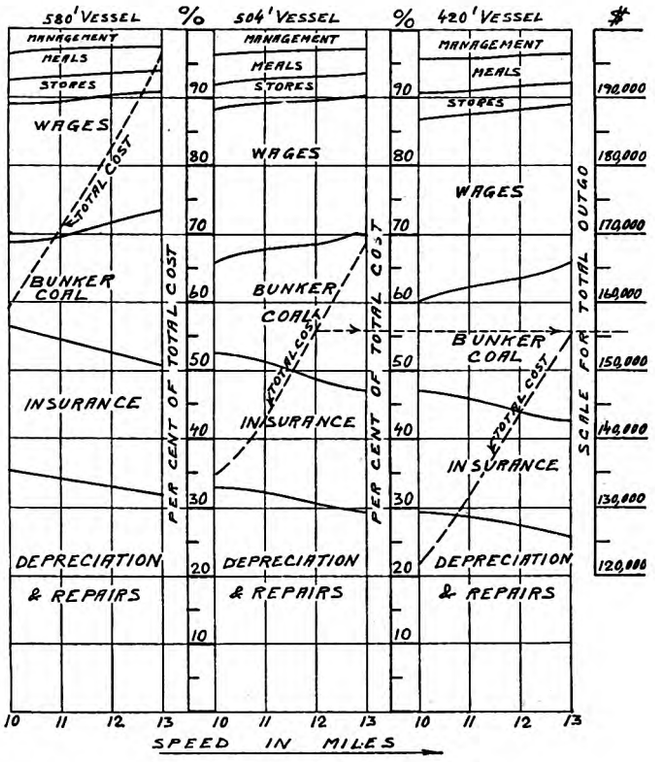

Fig. 13.—Cost of Operation

Speed in miles	10	11	12	13
Number of trips	16	18	20	22

Bunker coal at $6.00

As previously referred to, there is very often a serious delay at the grain elevators. If for this reason a ship would lose one more trip with iron ore, there would, with a rate of 3 cents a bushel for the grain, be no extra profits gained by taking the two cargoes of grain instead of three cargoes of iron ore. It is therefore rather common that the vessel owners in their grain contracts require a dispatch guaranty of $1,000 to $1,500 a day for each day a vessel is held in port beyond three days.

Fig. 9 clearly demonstrates that a high grain rate for only one or two trips may materially increase the profits for the entire season.

WAGES, MEALS, STORES, ETC.

In Fig. 10 is shown how a change in these factors may affect the results. It will be seen, for example, that an increase of wages of 10 percent will, for the conditions stated in the figure, reduce the profits from about 0.5 to 1 percent for the 580-foot vessel to about 0.7 of 1 percent

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for the 420-foot vessel. An increase of 10 percent in the total expenses of wages, meals, stores, and management will cut down the profits for the 580-foot vessel about 0.7 of 1 percent as compared with about 1 percent for the 420-foot vessel. In other words, the larger ships will suffer less from an increase in the running cost than the smaller ships.

Reduction in Horsepower

In order to investigate to what extent a saving could be effected if forms of less resistance were designed, I have made some calculations based on horsepower 5 percent less than given by the curves in Fig. 3 on which my other calculations are based. They are plotted in Fig. 10. It will be seen that there is an actual gain in profits varying from 0.3 to 0.7 of 1 percent when the price for bunker coal is $6. For a higher coal price the profits will, of course, be even further increased.

Other Types of Machinery

With turbine machinery, a coal consumption of 1.2 pounds per indicated horsepower has been assumed. The coal price was taken as $6 per ton. Against the saving of fuel has to be set the 12 percent charge for depreciation, upkeep, and insurance on the addition of the first cost of the more expensive turbine. It was found that, in order not to increase the cost of operation, the first cost of the turbine machinery must not be more than $35 per indicated horsepower above that of the reciprocating machinery. In other words, the turbine machinery had to cost less than $80 to $85 per indicated horsepower to be able to compete with the reciprocating engine.

For shipowners contemplating the building of new ships, the following points are, I believe, of special interest. They sum up, in a way, the results of the investigation.

1. Of vessels of ordinary proportions the 580-foot vessel is, in general, the best. One of 540-foot length is, however, very nearly as economical as the larger ship. A 540-foot vessel can with advantage be designed with a beam of about 63 feet. Fig. 14 indicates that such a vessel will be more economical than the present 580-foot vessels. For a 540-foot ship it seems to be best to adopt a block coefficient of about 0.875.

2. The available draft in the channels will undoubtedly in the future be increased. In order to take full advantage of an increase in the draft it will be necessary to construct the vessels with greater molded depth than at present. For a 540-foot vessel a molded depth of about 32 feet can probably be adopted.

3. With the present high coal prices it is not economical to increase the speed above 11½ to 12 statute miles (10 to 10.4 knots).

4. Owing to the higher first cost and the short season there seems, at present, to be no reason for experimenting with other types of drive such as turbines and Diesel engines.

KIND OF CARGO & RATE	NUMBER OF CARGOES SPEED IN MILES 10	11	12	13
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COAL @ 45 CENTS PER TON	5	5	5	5
GRAIN @ 3 CENTS PER BUSHEL	2	2	2	2

BUNKER COAL $6.00

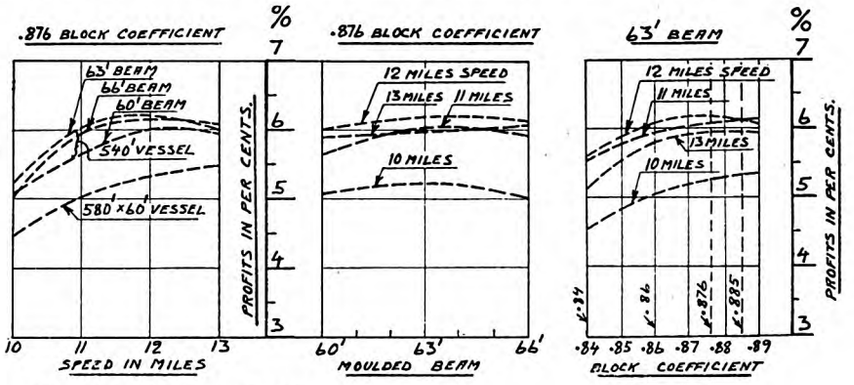

Fig. 14.—540-Foot Vessel

Steam-Line Filters

(*Continued from page* 746)

there are 100 packs in a filter, and that only 1 percent at a time is necessary for clearing out the deposit or residuum, it is obvious that an increase of 1 percent of the filter is sufficient to effect continuous complete filtration. As a rule, with ordinary filters an increase of 100 percent, that is double the capacity of filter, is required to obtain these results.

It is quite immaterial, except for purposes of convenience, in what position the packs are placed, and filtration is effected quite as well horizontally as vertically. The illustration shows the end and side elevation of a filter of the horizontal type, the disposition of the packs in this case being easily understood. There are 24 packs each 6 inches in length, each containing about 1,400 sheets; the whole filter thus contains approximately 34,000 sheets. As each separate pack is capable of filtering 50 gallons an hour, the whole filter will deal with 1,200 gallons an hour, or nearly 5½ tons an hour. The reason of the large discharge from a filter of comparatively small size can be understood from an example. Assuming the sheets to be so perforated as to contain 40 sources and sinks, that is 40 complete filtering units, there are obviously in the above example nearly one and a-half million units, or separate sources and sinks, continuously contributing their quota of filtration.

It is evident that the power required is not very great, since without considering losses, that is assuming efficiency of unity, filtration would be effected by a pump and motor of little more than ⅔ horsepower.

The natural inquiry of prospective users of the filter is as to the life of the paper employed for filtration. It must be remembered that the passage of the liquid between the sheets, *i.e.*, through the films, is slow, and there is practically no wear from this cause. As far as any other deterioration goes, up to the present, experience shows that neither water, oil, paraffin, nor even weak acid solutions seem to have the slightest effect on the paper, which, as it is waterproof and oilproof, appears to be capable of being employed successively for a number of purposes, as long as it is washed through before use with each different substance.

Dr. Hele-Shaw said further that the operation of the filter showed that no trace of solid matter penetrated between the sheets and that grit never passed between them. There was only a stream-line film of liquid between the surfaces and, consequently, it could not be conceived that these surfaces would wear out.

Various mixtures and solutions have been experimented with. With a mixture of dirty oil and water (bilge water) the oil took up the dirt and the dirt and oil separated from the water, but, if the oil were clean, the oil and water both came through the filter together and afterwards immediately separated.

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Failure of Condenser Tubes*

By William R. Webster†

Both tube makers and tube users have given much consideration to the problem of providing and securing tubes which would give maximum length of service, but due to the erratic nature of corrosive attack and the large element of time involved, it cannot be said that sufficient facts have been established on a basis of scientific procedure to make it at this time possible for anyone within certain very broad limits to predict with certainty that any particular lot of tubes will endure under average service conditions in a measurably superior degree to some other tubes differing from them in material respects. Since the matter is one of very great importance in the conduct of power installations, careful study of the problem in all of its aspects is well warranted in the interest of good engineering practice.

FEW problems relating to the operation of steam power plants, both marine and stationary, involve greater perplexities than those surrounding the endurance of the tubes employed in surface condensers where salt or contaminated cooling water is used. Failures experienced are of two kinds. One is due to spontaneous longitudinal splitting of the tube which is an exhibition of the phenomenon known as season cracking. The other is caused by the corrosive attack of the cooling water or of substances carried by it. In point of frequency of occurrence, the former is now of relatively minor importance, but because of the fact that when it is encountered it involves sudden and extensive leakage, its immediate results may be of greater consequence than failure due to corrosion because the latter is gradual in approach and manifestation.

Composition of Tubes

Originally most condenser tubes were made of a mixture of about 70 percent of copper and 30 percent of zinc, this composition being dictated by considerations affecting the manufacture rather than the performance of the tubes. Experience having demonstrated that the presence of a small amount of tin retarded the corrosive effects of sea water, some experiments were made in which one percent of tin was substituted for 1 percent of zinc, with the result that superior resistance to corrosion was obtained. This specification was originally adopted by the British Admiralty since which time the term "Admiralty mixture" or metal has been employed to designate it.

It was stated above that season cracking was a recognizable cause of tube failure. For this a complete and sufficient remedy is a moderate degree of annealing. It was originally the practice to furnish condenser tubes hard, *i.e.*, without any final heat treatment. No way is known to the art by which tubes so made can be positively assured against this trouble. On the writer's recommendation, the Bureau of Steam Engineering of the Navy Department somewhat over 20 years ago adopted specifications requiring that tubes be annealed after the final drawing operation. This practice has since become standard in this country although English manufacturers still continue to omit a final annealing.

The Admiralty mixture is hot short and can consequently not be made into tubes by the customary method of hot piercing a solid billet or blank. Instead the usual practice is to make the initial casting in the shape of a hollow cylinder. To form this, appropriate amounts of copper, zinc and tin, together with a suitable quantity of scrap, are brought to a molten state and then poured into a vertically disposed cylindrical mold of cast iron in the center of which a cylindrical sand core is supported.

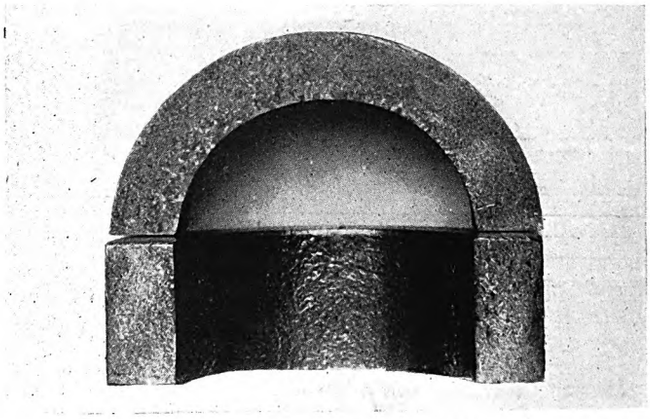
Only the highest grades of material obtainable are employed. While the impurities carried by slightly lower grades have never been proved to have an effect on service endurance they do affect the ductility of the material and cause a resulting increase in its cost of manufacture entirely out of proportion to any saving in initial cost.

Lead and iron are considered deleterious impurities. In excess both hamper the operations of the tube maker, and the latter in particular is believed to assist the attack of corrosive agencies. The effect of such other impurities as normally exist in well made brass has not been shown to be of material consequence.

Objection is sometimes made to the use of scrap, but if it is understood that the term scrap is not synonymous with junk and that an inferior mixture results if too large a proportion of elemental metals be employed, no grounds for such objection exist.

Process of Manufacture

The resulting casting, or shell, about 4 inches in outside diameter by 5/8 inch thick by 50 inches long, is by a succession of cold drawing operations reduced to a tube having



Longitudinal and Cross Section of an Acceptable Shell Casting

a cross sectional area of about 0.15 square inch involving an extension of each element of the original casting of 40 to 50 times. The severity of the first drawing operation is such that metal of an inferior quality, either due to unskillful casting or deleterious impurities, is unable to withstand it and breakage inevitably results. As the drawing operations continue, the tube becomes too long for convenient handling so that it is cut into appropriate lengths from time to time. Departure from the cast state increases the normal ductility of the metal somewhat so that later reductions are correspondingly greater than the initial ones.

Importance of Annealing

The annealing operation to which the tube is subjected is an important one since the ductility of the metal is within limits a function of the temperature to which it is heated

*From a paper on "Condenser Tubes" presented before the Metropolitan Section of the American Society of Mechanical Engineers in New York on November 8.

† Vice-president, Bridgeport Brass Company, Bridgeport, Conn.

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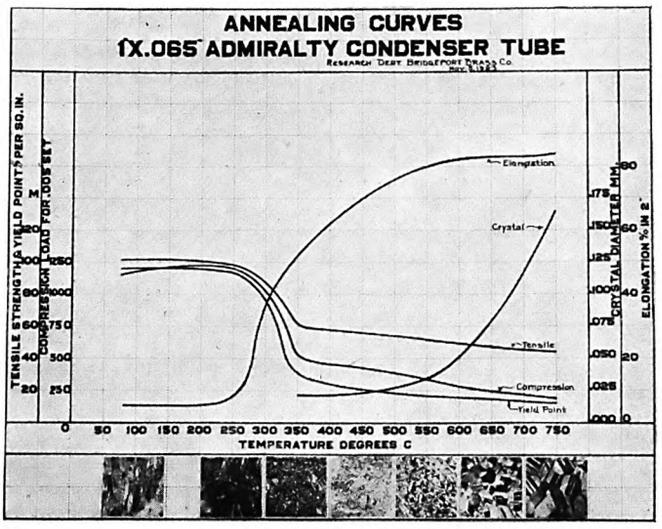
in the process. Since annealing is employed for the purpose of removing the hardening and embrittlement due to drawing, it is manifest that it should be so governed as to produce maximum ductility. Careful pyrometric control is therefore essential to good practice in this respect.

It was heretofore stated that one of the causes of tube failure was due to a phenomenon known as season cracking which could be prevented by annealing after the final drawing operation. By properly governing the drawing operations the tendency to season crack can be controlled to some degree, but it cannot by this means alone be eliminated with certainty.

Since a condenser tube when fully annealed is so soft as to be readily distorted by treatment incident to handling and installation, it is customary practice to modify the final



Curve Showing Relation Between Annealing Temperature, Physical Properties and Crystalline Structure of a Condenser Tube

anneal to a degree that will, while removing all liability to season cracking, still leave the tube hard enough to withstand handling.

The metallurgical microscope is an extremely useful instrument for determining whether the annealing operation has been so conducted as to prevent season cracking on the one hand and undue pliability on the other, but its value as a means of predicting service endurance has not been established by any well attested record of experience.

Failure Due to Season Cracking

It will be at once evident that failure due to season cracking is readily and completely avoidable, since the degree of annealing necessary to prevent it is well below the point at which the metal becomes unduly soft. In order to guard against this latter possibility it has sometimes been thought necessary to require that a unit length of the tube be capable of sustaining a specific load applied perpendicularly to its axis without taking a permanent set exceeding a certain amount. As the size of the crystals of the tube can be determined microscopically with a fair degree of approximation and since this size is proportionate to the softness of the tube, this requirement is unnecessary in the presence of a definite limit for the crystal or grain size. In this connection, however, it is desired to call attention to the fact that the factor of observational error involved in the measurement of crystal size is a large one.

Factors Affecting Endurance

While perfection of manufacturing practice may well be stressed as of importance in the way of good workmanship, experience does not indicate that it is of much consequence on the whole in preventing corrosive attack. The belief is very widely held that the control of annealing temperatures within close limits and extreme freedom from mechanical defects are essential to satisfactory endurance. In the former case, fortunately, ample evidence is available and merely lacks sufficient examination. The tubes in a condenser usually fail in succession, some giving a much longer life than others. Such failures must be due to causes either internal or external to the tubes. The latter in individual condensers do not usually vary greatly from tube to tube and when differences in this respect do occur, they can usually be detected. Under these circumstances, when variations in detectable internal conditions exist a sufficiently large number of observations should be able to determine with certainty any relation existing between any specific internal condition and superior or inferior service endurance.

For example, if a small crystal structure is more conducive to long life than one relatively large, the earlier failures in an individual condenser will be found upon examination to possess, on the average, larger crystals than those which fail subsequently, with some degree of proportionality observable between the crystal size and the life of the tube. Comparative examinations of large quantities of failed and unfailed tubes from the same condensers, while always showing variations in crystal size of considerable amounts, have not given the slightest support to this belief.

Similarly, attempts to explain observed failures by the presence of mechanical imperfections have been unfruitful. Dr. G. D. Bengough, in discussing this factor, has stated that "in my (his) experience it is very rare for tubes to fail from this cause." Should, however, the facts above mentioned be admitted by all, that alone would contribute but little to the solution of the problem of condenser tube failure. On the other hand, if such admission should serve to direct attention to the importance and necessity of more intensive study of the causes of corrosion which reside within the condenser, much would have been accomplished in the direction of substantial progress.

A discussion of the precise mechanism of the corrosive attack involved in the failure of condenser tubes is beyond the scope of this paper. Suffice it to say, therefore, that the corrosive agencies existing in the average surface condenser using sea water are sufficiently active to make the destruction of any brass tube only a question of time, and that the reason why brass tubes last on the whole as well as they do is that corrosive action is usually accompanied by the formation of by-products which are distinctly protective. Specifically, if a piece of condenser tube be immersed in warm salt water containing air bubbles, corrosive attack will continue for a considerable period at a rate sufficient to completely dissolve it in a very few months. Also corrosive attack of a character not involving the formation of a protective coating may occur under perfectly normal conditions and proceed at a rate sufficiently rapid to perforate the tube in a few weeks.

Plug Type Dezincification

Investigations of the subject of condenser tube corrosion have established the existence of a considerable number of distinctive types of attack. Probably the most troublesome is that usually known as "plug type dezincification," wherein approximately circular areas of the tube wall of small size are so attacked that the zinc appears to have been dissolved out, leaving a spongy mass or plug of copper behind.

This action once set up continues at a rapid rate until the wall of the tube is perforated. The spongy copper is not strongly adherent, and frequently falls or is washed out of place, leaving an approximately circular hole.

This type of corrosion is the one which usually accounts for the rapid failure of new tubes. Perforations from this

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Inside Surface of Tube, Showing Plug Type Dezincification. The Tube Has Been Split Longitudinally

cause may take place within a few months or even weeks from the time the tubes are installed. The chemical reactions involved are complex but appear to be favored by a high degree of salinity. Frequently the attack occurs along the bottom element of the tube under conditions indicating that, when drained, water has collected in the bottom and that concentration due to evaporation has occurred. Attempts to produce this action experimentally have not been entirely conclusive. A slight inclination of the condenser so that the tubes will drain dry and the avoidance of sagging appear to have value as preventive measures, and should always be adopted. Frequent thorough cleaning of the tubes when new is also desirable, particularly if the condenser is out of service for extended periods.

Under certain circumstances a type of corrosion resembling this is encountered which differs from it in that the action instead of being localized occurs quite regularly throughout the entire wall of the tube and proceeds at a much slower rate until the whole tube becomes brittle and lacking in strength. This is observed usually only in installations that have been in operation for many years although Muntz metal tubes generally fail in sea water from this cause in a relatively short time.

Quite frequently failures occur from an action as a result of which the wall of the tube is dissolved in an irregular manner, sometimes involving extensive areas and sometimes quite restricted ones. Continuous action of this character usually reduces the thickness of the tube particularly at and near the inlet end so that the packing no longer functions although it frequently localizes in a way that produces perforation without much thinning of the adjacent portions. Dr. Bengough has investigated this type of failure and proved conclusively that it is due to the presence of entrained air in the condensing water. This may be due to

Structure of Tube Which Gave an Extraordinary Life

Copper Plug Magnified

various causes such as improper design of circulating pumps, leaks in the suction line or disturbances in the vicinity of the intake. He recommends soaking the tubes in quiescent sea water at 40 degrees C. for about a week. This appears to form a protective coating.

PREVENTATIVE MEASURES

In general tubes should be cleaned as frequently as possible, particularly when first installed. Deposits of foreign matter, especially when foul water is used, are frequently of a highly corrosive nature. In the writer's experience iron protective plates properly attached to the tube sheets have a distinct value and should always be employed. The omission of the final pickling operation so as not to disturb the oxide scale formed in the final anneal has been recommended by a distinguished authority. Experimental observations indicate that it is well worthy of extended trial.

This discussion heretofore has concerned itself only with tubes of Admiralty mixture as their use is indicated in most cases where corrosive action is to be expected. In installations employing uncontaminated fresh water Muntz metal gives satisfactory results. This mixture, which is approxi-

Sections of Condenser Tube, One Part of Which Has Been Perforated Due to Entrained Air Corrosion; the Other Portion of Which, While Entirely Free from Attack, Shows a Large Spill

mately 60 percent copper and 40 percent zinc, is inherently cheaper than Admiralty and the process of manufacture less costly, due to the fact that it is capable of being worked hot.

The writer has for years vigorously opposed the contentions of those who hold the belief that crystalline structure or mechanical imperfections are causative accompaniments of corrosive attack, and in support of his position has presented evidence and cited authority. The attitude is and was not dictated by any lack of appreciation of the importance of these factors from the standpoint of good workmanship and practice, but results solely from the conviction that as long as their suspected presence is assumed to account for premature failures the sufficient remedy for which lies in increased severity of inspection, no progress in determining and controlling the factors depending on condenser design and operation is to be expected.

SPECIFICATIONS

Engineers in the endeavor to avoid the very serious difficulties incident to the premature failure of tubes in service have exhibited considerable ingenuity and industry in drawing exacting and conflicting specifications. It can, however,

(*Continued on page* 783)

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Applications of Arc Welding to Ship Construction—V

Tables Showing Time Required for Various Type Electric Welded Joints as Compared with Riveted Construction

By E. H. Ewertz*

IN comparison with riveted construction, the use of electric arc welding in ship work shows a reduction in weight and a saving in the time element—with consequent savings in cost. Instances have previously been mentioned in this series of articles where weight in hull construction has been reduced over 25 percent while the hours of labor have been cut 20 percent. Examples are also mentioned in cross channel barge assembly where 245 man-hours were saved in the construction and more than 1,000 pounds of metal saved by utilizing welding instead of riveting. The tabulations in this installment deal mainly with the time factor in connection with ship welding.

Cost Savings of Welding

The cost saving element of welding in ship work has already been discussed in the analysis of the work on cost data as carried out under the supervision of Mr. W. S. Wakeman, general manager of the Fore River Plant of the Bethlehem Shipbuilding Corporation. The results of the investigations were published in Tables 1 to 10 on pages 628-629 of the October issue of Marine Engineering and Shipping Age.

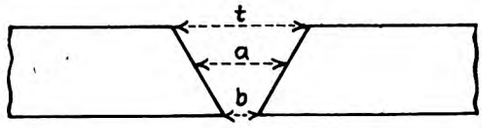
Reference was also made on page 628 to Tables 12 to 24 which appear below as showing in tabulated form the time required to weld seams and holes. As can readily be understood, precautions were taken in making the tests to be certain that operators were competent and that the best of material and equipment were used. The work was done by both the General Electric Company and the Lincoln Electric Company machines and bare electrodes employed in all instances.

TABLE 12.—To convert time required for one size welding wire to that required for another size

Time for	1/8	inch to that for	5/32	inch; multiply by	.64
Time for	1/8	inch to that for	3/16	inch; multiply by	.444
Time for	1/8	inch to that for	1/4	inch; multiply by	.25
Time for	5/32	inch to that for	1/8	inch; multiply by	1.56
Time for	5/32	inch to that for	1/4	inch; multiply by	.39
Time for	3/16	inch to that for	1/8	inch; multiply by	2.25
Time for	3/16	inch to that for	5/32	inch; multiply by	1.44
Time for	3/16	inch to that for	1/4	inch; multiply by	.56
Time for	1/4	inch to that for	1/8	inch; multiply by	4.00
Time for	1/4	inch to that for	5/32	inch; multiply by	2.56
Time for	1/4	inch to that for	3/16	inch; multiply by	1.78

TABLE 13.

Having measured the distance across bottom and top of seam to be welded this table gives the average distance across seam in decimals. Enter Table 14 with this average distance (a) to get minutes per foot



	Thickness of Stock in Inches													
	0	1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
	Average distance (a).													
1/8	.06	.09	.12	.16	.19	.25	.31	.37	.44	.5	.56	.62	.69	.75
1/4	.12	.16	.19	.22	.25	.31	.37	.44	.5	.56	.62	.69	.75	.81
3/8	.19	.22	.25	.28	.31	.37	.44	.5	.56	.62	.69	.75	.81	.87
1/2	.25	.28	.31	.34	.37	.44	.5	.56	.62	.69	.75	.81	.87	.94
5/8	.31	.34	.37	.41	.44	.5	.56	.62	.69	.75	.81	.87	.94	1.
3/4	.37	.41	.44	.47	.5	.56	.62	.69	.75	.81	.87	.94	1.	1.06
7/8	.44	.47	.5	.53	.56	.62	.69	.75	.81	.87	.94	1.	1.06	1.12
1	.5	.53	.56	.59	.62	.69	.75	.81	.87	.94	1.	1.06	1.12	1.19
1 1/8	.56	.59	.62	.66	.69	.75	.81	.87	.94	1.	1.06	1.12	1.19	1.25
1 1/4	.62	.66	.69	.72	.75	.81	.87	.94	1.	1.06	1.12	1.19	1.25	1.31
1 3/8	.69	.72	.75	.78	.81	.87	.94	1.	1.06	1.12	1.19	1.25	1.31	1.37
1 1/2	.75	.78	.81	.84	.87	.94	1.	1.06	1.12	1.19	1.25	1.31	1.37	1.44
1 5/8	.81	.84	.87	.91	.94	1.	1.06	1.12	1.19	1.25	1.31	1.37	1.44	1.5
1 3/4	.87	.91	.94	.97	1.	1.06	1.12	1.19	1.25	1.31	1.37	1.44	1.5	1.56
1 7/8	.94	.97	1.	1.03	1.06	1.12	1.19	1.25	1.31	1.37	1.44	1.5	1.56	1.62
2	1.	1.03	1.06	1.09	1.12	1.19	1.25	1.31	1.37	1.44	1.5	1.56	1.62	1.69
2 1/8	1.06	1.09	1.12	1.16	1.19	1.25	1.31	1.37	1.44	1.5	1.56	1.62	1.69	1.75
2 1/4	1.12	1.16	1.19	1.22	1.25	1.31	1.37	1.44	1.5	1.56	1.62	1.69	1.75	1.81
2 3/8	1.19	1.22	1.25	1.28	1.31	1.37	1.44	1.5	1.56	1.62	1.69	1.75	1.81	1.87
2 1/2	1.25	1.28	1.31	1.34	1.37	1.44	1.5	1.56	1.62	1.69	1.75	1.81	1.87	1.94
2 5/8	1.31	1.34	1.37	1.41	1.44	1.5	1.56	1.62	1.69	1.75	1.81	1.87	1.94	2.
2 3/4	1.37	1.41	1.44	1.47	1.5	1.56	1.62	1.69	1.75	1.81	1.87	1.94	2.	2.06
2 7/8	1.44	1.47	1.5	1.53	1.56	1.62	1.69	1.75	1.81	1.87	1.94	2.	2.06	2.12
3	1.5	1.53	1.56	1.59	1.62	1.69	1.75	1.81	1.87	1.94	2.	2.06	2.12	2.19
3 1/8	1.56	1.59	1.62	1.66	1.69	1.75	1.81	1.87	1.94	2.	2.06	2.12	2.19	2.25
3 1/4	1.62	1.66	1.69	1.72	1.75	1.81	1.87	1.94	2.	2.06	2.12	2.19	2.25	2.31
3 3/8	1.69	1.72	1.75	1.78	1.81	1.87	1.94	2.	2.06	2.12	2.19	2.25	2.31	2.37
3 1/2	1.75	1.78	1.81	1.84	1.87	1.94	2.	2.06	2.12	2.19	2.25	2.31	2.37	2.44
3 5/8	1.81	1.84	1.87	1.91	1.94	2.	2.06	2.12	2.19	2.25	2.31	2.37	2.44	2.5
3 3/4	1.88	1.91	1.94	1.97	2.	2.06	2.12	2.19	2.25	2.31	2.37	2.44	2.5	2.56
3 7/8	1.94	1.97	2.	2.03	2.06	2.12	2.19	2.25	2.31	2.37	2.44	2.5	2.56	2.62
4	2.	2.03	2.06	2.09	2.12	2.19	2.25	2.31	2.37	2.44	2.5	2.56	2.62	2.69

Distance (t) across top of seam.
Distance (b) across bottom of seam, in inches.

*General manager, Moore Plant, Bethlehem Shipbuilding Corporation, Ltd., Elizabeth, N. J.

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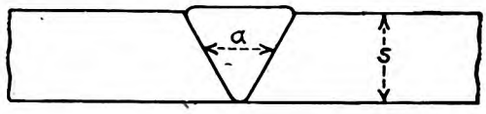
PROPER DESIGN OF JOINTS NECESSARY FOR WELDING

It is certain that considerable saving can be made by the use of the electric arc welding method if the joints are designed for this purpose, and from the little data given, it is evident that a saving in material with the corresponding increase in carrying capacity is made possible in an electric welded ship.

A vast number of strength tests of welded joints as well as similar joints riveted have been made by the Government as well as by societies, manufacturers of welding machines, manufacturers of electrodes, and by private individuals, and as it is only possible to give a small portion of such tests in this paper, additional information on this subject can be had from books and papers listed in the bibliography.

TABLE 14.

Actual minutes required to weld one foot of seam, flat and backed. This does not include time for incidental work, such as handling.



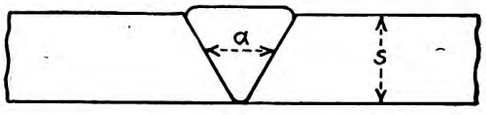
Thickness of Stock in Inches

Minutes to Weld One Foot of Seam

Average width (a) across the seam. See Table 13.	1/8	5/32	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
.1	4	5	6	5	6	7	8	10	11	13	14	16	17	19
.2	8	10	12	10	11	14	17	20	23	26	29	32	35	38
.3	12	15	19	14	17	21	25	30	34	39	43	48	52	57
.4	16	20	25	19	22	28	34	40	46	52	58	64	70	76
.45	18	23	28	21	25	31	38	45	52	58	65	72	78	85
.5	20	25	31	24	27	35	42	50	57	65	72	80	87	95
.55	22	28	34	26	30	38	47	55	63	71	80	88	96	104
.6	23	30	37	28	33	42	51	60	69	78	87	96	105	114
.65	25	33	41	31	35	45	55	65	75	84	94	105	114	124
.7	27	36	44	33	38	49	59	70	80	91	101	112	122	133
.75	29	38	47	36	41	52	64	75	86	97	109	120	131	142
.8	31	41	50	38	44	56	68	80	92	104	116	128	140	152
.85	33	43	53	40	47	59	72	85	98	110	123	136	149	161
.9	35	46	56	43	49	63	76	90	103	117	130	144	157	171
.95	37	48	59	45	52	66	81	95	109	123	138	152	166	180
1.0	39	51	62	48	55	70	85	100	115	130	145	160	175	190
1.1	43	56	68	52	60	77	93	110	126	143	160	176	192	209
1.2	47	61	75	57	66	84	102	120	138	156	174	192	210	228
1.3	51	66	81	62	71	91	110	130	149	169	188	208	227	247
1.4	55	71	87	66	77	98	119	140	161	182	203	224	245	266
1.5	58	76	93	71	82	105	127	150	172	195	217	240	262	285
1.6	62	81	98	76	88	112	136	160	184	208	232	256	280	304
1.7	66	85	100	81	93	119	144	170	195	221	246	272	297	323
1.8	70	91	112	85	99	126	153	180	207	234	261	288	315	342
1.9	74	96	118	90	104	133	161	190	218	247	275	304	332	361
2.	78	100	125	95	110	140	170	200	230	260	290	320	350	380
	1/8" Wire			5/16" Wire										

TABLE 15.

Actual minutes required to weld one foot of seam. This time includes all items except moving. (See Table 13.)



Thickness of Stock in Inches

Minutes to Weld One Foot of Seam

Average width (a) of seam in inches. See Table 13.	1/8	5/32	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
.1	5	6	7	6	7	9	10	12	14	16	17	19	21	23
.2	9	12	15	11	13	17	20	24	28	31	35	38	42	46
.3	14	18	22	17	20	25	31	36	41	47	52	58	63	68
.4	18	24	29	23	26	34	41	48	55	62	70	77	84	91
.45	21	27	33	25	30	39	46	54	62	70	78	86	94	103
.5	23	30	37	28	33	42	51	60	69	78	87	96	105	114
.55	25	33	40	31	36	46	56	66	76	86	96	105	115	125
.60	28	36	44	34	40	50	61	72	83	94	104	115	126	137
.65	30	39	48	37	42	55	67	78	90	101	113	125	136	148
.7	32	42	51	40	46	59	71	84	97	109	121	134	147	159
.75	34	45	55	43	49	63	76	90	103	117	130	144	157	170
.8	37	48	59	46	53	67	82	96	110	125	139	154	168	182
.85	39	51	62	49	56	71	85	102	116	132	146	163	178	193
.9	41	54	66	51	59	75	92	108	124	140	156	172	189	205
.95	44	57	70	54	63	80	97	114	131	148	165	182	200	215
1.	46	60	73	57	66	84	102	120	138	156	174	192	210	228
1.1	51	66	81	63	73	92	112	132	152	171	191	211	231	250
1.2	55	72	88	68	79	101	122	144	165	187	209	230	252	274
1.3	60	78	95	74	86	109	132	156	179	203	226	250	273	296
1.4	64	83	103	80	92	117	143	168	193	218	243	269	294	319
1.5	69	90	110	85	99	126	153	180	207	234	261	288	315	342
1.6	73	95	118	91	105	134	163	192	221	250	278	307	336	365
1.7	78	101	125	97	112	143	173	204	234	265	296	326	357	388
1.8	83	107	132	102	119	151	184	216	249	281	313	343	378	410
1.9	87	113	140	108	125	160	194	228	262	296	330	365	400	433
2.	92	119	147	114	132	168	204	240	276	312	348	384	420	460
	1/8" Wire			5/16" Wire										

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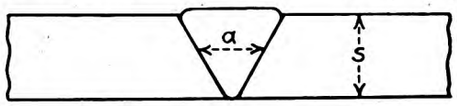
TABLE 16.—OVERHEAD, REINFORCED, BUTT JOINTS

Actual minutes required to weld one foot of seam. This table includes all items except moving. (See Table 13.)

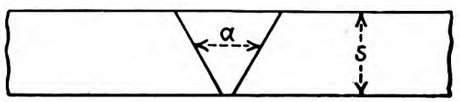


Thickness of Stock in Inches

Average width (a) of seam in inches.	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2
.1	8	10	12	10	11	14	17	20	23	26	29	32	35	38
.2	16	20	25	19	22	29	34	40	46	52	58	64	70	76
.3	23	30	37	29	33	42	51	60	69	78	87	96	105	114
.4	31	40	50	38	44	56	68	80	92	104	116	128	140	152
.45	35	46	56	43	49	63	76	90	103	117	130	144	157	171
.5	39	51	62	48	55	70	85	100	115	130	145	160	175	190
.55	43	56	69	52	61	77	93	110	126	143	159	176	192	209
.6	47	61	75	57	67	84	102	120	138	156	174	192	210	228
.65	51	66	81	61	70	91	110	130	149	169	188	208	227	247
.7	55	71	87	66	77	98	119	140	161	182	203	224	245	266
.75	58	76	94	72	82	105	127	150	172	195	217	240	263	283
.8	62	81	100	76	88	112	136	160	184	208	232	256	280	304
.85	67	86	106	81	93	119	144	170	195	221	246	272	297	321
.9	70	91	112	86	99	126	153	180	207	234	261	288	315	342
.95	74	96	118	91	104	133	161	190	218	247	275	304	333	361
1.	78	102	125	95	110	140	170	200	230	260	290	320	350	380
1.1	86	112	137	104	121	154	187	220	253	286	319	352	385	418
1.2	94	122	150	114	132	168	204	240	276	312	348	384	420	456
1.3	101	132	162	123	143	182	221	260	299	338	397	416	455	494
1.4	109	142	175	133	154	196	238	280	322	364	406	448	490	532
1.5	117	152	187	142	165	210	255	300	345	390	435	480	525	570
1.6	123	162	200	152	176	224	272	320	368	416	464	512	560	608
1.7	132	172	212	161	187	238	289	340	391	442	493	544	595	646
1.8	140	182	224	171	198	252	306	360	414	468	522	576	631	684
1.9	148	192	237	180	209	266	323	380	437	494	551	608	665	722
2.	156	202	250	190	220	280	340	400	460	520	580	640	700	760

TABLE 17.

Actual minutes required to weld one foot of seam. This time includes all items except moving. (See Table 13.)



Thickness of Stock in Inches

Average width (a) of seam in inches.	1/8	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
.1	2	4	5	4	5	5	6	8	9	10	12	13	15	16
.2	5	7	9	8	9	10	12	15	18	21	24	27	30	33
.3	7	10	14	11	13	16	18	22	27	31	36	40	45	49
.4	13	14	19	15	18	21	24	30	36	42	48	54	60	66
.5	12	18	23	19	22	26	30	37	45	52	60	67	75	82
.6	14	21	28	22	27	31	36	45	54	63	72	81	90	99
.7	16	25	33	26	31	37	42	52	63	73	84	94	105	115
.8	19	28	37	30	36	42	48	60	72	84	96	108	120	132
.9	21	32	42	34	40	47	54	67	81	94	108	121	135	148
1.	23	34	47	37	45	52	60	75	90	105	120	135	150	165
1.1	26	39	51	41	49	58	66	82	99	115	132	148	165	181
1.2	28	42	56	45	54	63	72	90	108	126	144	162	180	198
1.3	30	46	61	49	58	68	78	97	117	136	156	175	195	214
1.4	33	49	65	52	63	73	84	105	126	147	168	189	210	231
1.5	35	52	70	56	67	79	90	112	135	157	180	202	225	247
1.6	37	56	75	60	72	84	96	120	144	168	192	216	240	261
1.7	40	60	79	64	76	89	102	127	153	178	204	229	255	280
1.8	42	63	85	67	81	94	108	135	162	189	216	243	270	297
1.9	44	67	89	71	85	100	114	142	171	199	228	256	285	313
2.	47	70	94	75	90	105	120	150	180	210	240	270	300	330
2.1	49	74	98	79	94	110	126	157	189	220	252	283	315	346
2.2	51	77	103	82	99	115	132	165	198	231	264	297	330	363
2.3	54	81	107	86	103	121	138	172	207	241	276	310	345	379
2.4	56	84	112	90	108	126	144	180	216	252	288	324	360	396
2.5	58	88	117	94	112	131	150	187	225	262	300	337	375	412
2.6	61	91	121	97	117	136	156	195	234	273	312	351	390	428
2.7	63	95	126	103	121	141	162	202	243	283	324	364	405	445
2.8	65	98	131	105	126	147	168	210	252	294	336	378	420	462
2.9	68	101	135	108	130	152	174	217	261	302	348	391	435	478
3.	70	105	140	112	135	157	180	225	270	312	360	405	450	495

For vertical and horizontal seams multiply by 1.2.
For overhead seams multiply by 2.

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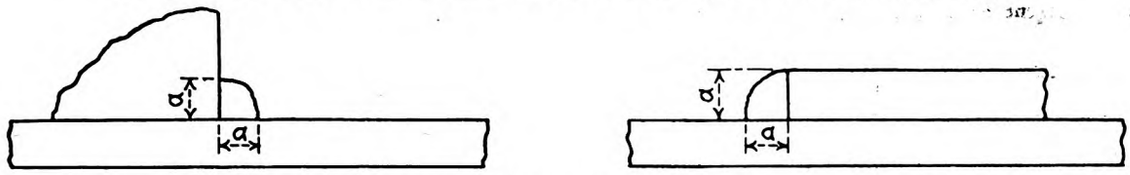
TABLE 18.—FILLET WELDING. Actual minutes required to weld one foot of seam



For seams up to and including ¼ inch time is for ⅛ inch wire. Larger seams are estimated for 5/32 inch wire

Average width (a) of weld in inches.	Without Rest of Incidental Work				For Shop Work Includes All Items				For Ship Work Does Not Include Moving			
	Flat	Horiz.	Vertic.	Overh.	Flat	Horiz.	Vertic.	Overh.	Flat	Horiz.	Vertic.	Overh.
⅛	3.1	3.7	3.7	6.2	4	4.8	4.8	8	4.3	5.2	5.2	8.6
3/16	4.1	4.9	4.9	8.2	5.4	6.5	6.5	10.8	5.8	7	7	11.6
¼	4.9	5.9	5.9	9.8	6.4	7.7	7.7	12.8	6.9	8.3	8.3	13.8
5/16	6.5	7.8	7.8	13	8.5	10.2	10.2	17	9.2	11	11	18.4
⅜	8.1	9.7	9.7	16.2	10.6	12.7	12.7	21.2	11.4	13.7	13.7	22.8
7/16	10.1	12.1	12.1	20.2	13.2	15.8	15.8	26.4	14.2	17	17	28.4
½	12.7	15.2	15.2	25.4	16.5	19.8	19.8	33	17.8	21.4	21.4	35.6
9/16	16.2	19.4	19.4	32.4	21	25.2	25.2	42	22.7	27.2	27.2	45.4
⅝	21.2	25.4	25.4	42.4	27.6	33.2	33.2	55.2	29.6	35.5	35.5	59.2

TABLE 19.—FILLING ROUND, FLAT, BACKED HOLES. Actual minutes required per hole

This time includes all items except moving

Diameter of hole, in inches.	Depth of hole, in inches											
	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	
¼	.2	.3	.3	.4	.5	.6	.7	.7	.8	.9	1	For ⅛" wire
⅜	.4	.6	.8	1	1.1	1.4	1.6	1.7	1.9	2.1	2.3	
½	.7	1.	1.3	1.7	2	2.3	2.7	3	3.3	3.7	4	
⅝	.8	1.2	1.6	1.9	2.3	2.7	3.1	3.5	3.8	4.2	4.6	
¾	1.1	1.7	2.2	2.8	3.3	3.9	4.4	5	5.5	6.1	6.6	
⅞	1.5	2.3	3	3.7	4.5	5.2	6	6.7	7.5	8.2	9	
1	2	2.8	3.6	4.9	5.6	6.7	7.8	8.8	9.9	10.6	11.5	
1⅛	2.5	3.7	5	6.2	7.5	8.7	10	11.2	12.5	13.7	15	
1¼	3	4.6	6.1	7.6	9.2	10.7	12.2	13.8	15.3	11.8	18.4	For 3/32" wire
1⅜	3.8	5.6	7.4	9.3	11.1	13	14.8	16.7	18.6	15.	22.2	
1½	4.4	6.6	8.8	11	13.2	15.4	17.7	19.8	22	18.4	26.5	
1⅝	5.1	7.8	10.4	12.9	15.5	18.1	20.7	23.3	25.9	28.5	31.1	
1¾	6	9	12	15	18	21	24	27	30	33	36	
1⅞	6.9	10.4	13.8	17.2	20.7	24.1	27.6	31	34.5	38	41.4	
2	7.9	11.8	15.7	19.6	23.5	27.5	31.4	35.3	39.3	43	47.1	

TABLE 20.—Actual minutes required per hole. This time includes all items except moving

Average width (a) of weld in inches.	Depth of hole in inches											
	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	
¼	.2	.3	.4	.5	.6	.7	.8	.9	1	1.1	1.2	For ⅛" wire
⅜	.4	.7	.9	1.1	1.3	1.6	1.9	2.	2.3	2.5	2.7	
½	.8	1.2	1.6	2.	2.4	2.8	3.2	3.7	4.	4.4	4.8	
⅝	.9	1.4	1.9	2.3	2.8	3.2	3.7	4.1	4.6	5.	4.5	
¾	1.3	2.	2.6	3.3	4.	4.6	5.3	6.	6.6	7.3	7.9	
⅞	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9.	9.9	10.8	
1	2.3	3.4	4.3	5.9	6.7	8.	9.4	10.6	11.9	12.8	13.7	
1⅛	3	4.5	6	7.5	9	10.5	12.	13.5	15.	16.5	18.	
1¼	3.7	5.5	7.3	9.2	11	12.8	14.7	16.5	18.4	20.2	22.	For 3/32" wire
1⅜	4.4	6.7	8.9	11.1	13.4	15.6	17.8	20.	22.3	24.5	26.7	
1½	5.3	8.	10.6	13.2	16.	18.5	21.2	23.8	26.5	29.1	31.7	
1⅝	6.2	9.3	12.4	15.5	18.6	21.8	24.9	28.	31.	34.2	37.4	
1¾	7.2	10.8	14.4	18.	21.6	25.2	24.8	32.4	36.	39.6	43.2	
1⅞	8.3	12.4	16.6	20.7	24.8	29.	33.1	37.3	41.4	45.5	49.7	
2	9.4	14.1	18.9	23.6	28.3	33.	37.7	42.4	47.1	51.8	56.6	

TABLE 21.—FILLING ROUND, OVERHEAD, BACKED HOLES. Actual minutes required per hole

This time includes all items except moving

Diameter of hole, in inches.	Depth of hole in inches											
	¼	⅜	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	
¼	.3	.5	.6	.8	1	1.1	1.3	1.5	1.8	1.9	2	For ⅛" wire
⅜	.7	1.1	1.5	1.9	2.2	2.7	3.1	3.4	3.7	4.1	4.5	
½	1.3	2	2.7	3.3	4	4.7	5.3	6.1	6.6	7.3	8	
⅝	1.5	2.3	3.5	3.8	4.6	5.3	6.1	6.9	7.6	8.4	9.2	
¾	2.2	3.3	4.4	5.5	6.6	7.7	8.8	10	11	12.1	13.2	
⅞	3	4.5	6	7.5	9	10.5	12	13.5	15	16.5	18	
1	3.9	5.6	7.3	9.8	11.2	13.4	15.7	17.7	19.8	21.3	23	
1⅛	5	7.5	10	12.5	15	17.5	20	22.5	25	27.5	30	
1¼	6.1	9.2	12.2	15.3	18.3	21.4	24.5	27.6	30.6	33.7	36.7	For 3/32" wire
1⅜	7.4	11.1	14.9	18.6	22.3	26	29.7	33.4	37.7	40.8	44.5	
1½	8.8	13.2	17.6	22	26.5	30.8	35.3	39.7	44.1	48.5	53	
1⅝	10.3	15.6	20.8	25.8	31	36.3	41.5	46.6	51.8	57.1	62.3	
1¾	12	18	24	30	36	42	48	54	60	66	72	
1⅞	13.8	20.7	27.7	34.5	41	48.3	55.2	62	69	75.9	82.8	
2	15.7	23.6	31.4	39.3	47.1	55	62.8	71	79.5	86.4	94.3	

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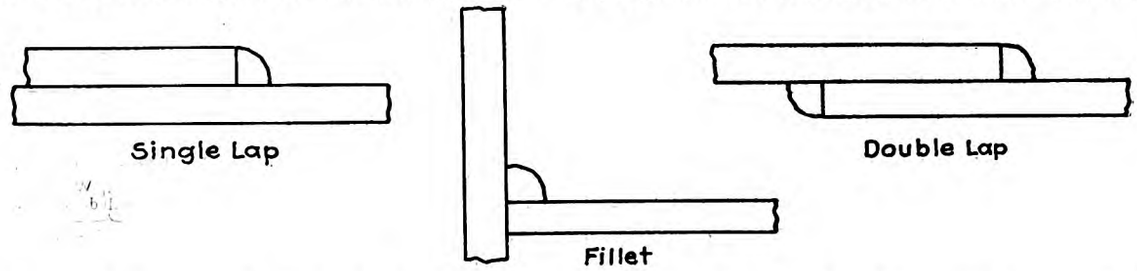
TABLE 22.—Cost of Welding Single and Double Lap or Fillet Joints Electrically, when done by average fast man at 82c per hour; current at 3c per kwh. and welding wire at 8.2c per pound. No overhead costs are included in this table

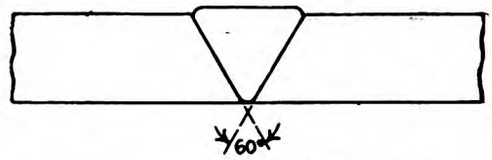


Thickness of Plate	Feet Per Hour	Kw. Hrs. Per Foot	Lbs. of Wire Per Foot	Cost of Labor in Cents	Cost of Current in Cents	Cost of Wire in Cents	Total Cents Single	Cost in Per Ft. Double
1/16	22	.08	.07	3.72	.24	.57	4.53	9.06
⅛	15.4	.12	.1	5.33	.36	.82	6.51	13.02
3/16	11.8	.18	.13	6.95	.54	1.06	8.55	17.10
¼	9.5	.24	.16	8.64	.72	1.31	10.67	21.34
5/16	7.	.36	.20	11.7	1.08	1.64	14.42	28.84
⅜	5.7	.46	.25	14.4	1.38	2.05	17.83	35.76
½	3.6	.8	.45	22.8	2.4	3.69	28.89	57.78
⅝	2.2	1.5	.75	37.2	4.5	6.15	47.85	95.70

For vertical seams multiply by 1.2.
For overhead seams multiply by 2.

TABLE 23.

Cost of Welding Single "V" butt seams, electrically, when done by average fast man at 82c per hour; current at 3c per kwh. and welding wire at 8.2c per pound. Flat work and backed. No overhead costs are included.



"S" Stock	Feet Per Hr.	Mins. Per Ft.	Kw. Hrs. Per Ft.	Lbs. Wire Per Ft.	Cost of Labor Per Ft.	Cost of Current Per Ft.	Cost of Wire Per Ft.	Total Cost Per Foot		
								Flat	Vertical	Overhead
⅛	7.5	8	1.6	.3	$0.11	$0.05	$0.03	$0.19	$0.23	$0.38
3/16	5	12	2.1	.4	.16	.07	.04	.27	.33	.54
¼	3.5	17	3.4	.6	.23	.10	.05	.38	.46	.76
⅜	3.1	19	1.3	.64	.26	.04	.06	.36	.44	.72
½	2	30	2	1	.41	.06	.09	.56	.67	1.12
⅝	1.5	41	2.7	1.5	.56	.08	.12	.76	.92	1.52
¾	1.1	56	3.7	1.9	.77	.11	.16	1.04	1.25	2.08
⅞	.92	71	4.7	2.4	.97	.14	.20	1.31	1.57	2.62
1	.63	94	6.3	3.2	1.29	.19	.27	1.75	2.10	3.50
1⅛	.5	120	8	4	1.64	.24	.33	2.21	2.66	4.42
1¼	.44	134	8.9	4.5	1.83	.27	.37	2.47	2.97	4.94
1⅜	.37	161	10.7	5.4	2.20	.32	.45	2.97	3.57	5.94
1½	.32	184	12.2	6.2	2.57	.37	.51	3.45	4.14	6.90

TABLE 24.—Cost, per hole, for filling flat round holes, under good working conditions. Labor 82c per hour. Wire 8.2c per pound and current at 3c per kilowatt hour. No overhead costs are included. No moving is included in these figures

Diameter	Depth	Mins.	Current in Kw. Hrs.	Lbs. Wire Used	Cost of Labor	Cost of Current	Cost of Wire	Total Cost	Cost Per Scattered Hole Aboard. All Items Included
⅜	⅛	.3	.06	.014	$0.004	$0.002	$0.002	$0.008	$0.016
⅜	¼	.4	.08	.028	.006	.003	.002	.011	.022
⅜	⅜	.6	.12	.042	.008	.004	.004	.016	.032
½	¼	.7	.14	.04	.01	.004	.004	.018	.036
½	⅜	1	.2	.06	.014	.006	.006	.026	.052
½	½	1.3	.26	.08	.018	.008	.006	.032	.064
⅝	⅜	1.2	.24	.09	.017	.008	.008	.033	.066
⅝	½	1.6	.32	.114	.022	.01	.01	.042	.084
⅝	⅝	1.9	.38	.14	.026	.011	.012	.049	.098
¾	½	2.2	.44	.16	.03	.013	.014	.057	.114
¾	⅝	2.8	.56	.2	.038	.017	.016	.063	.126
¾	¾	3.3	.66	.24	.045	.02	.02	.085	.17
⅞	⅝	3.7	.74	.11	.05	.022	.024	.096	.192
⅞	¾	4.5	.9	.25	.061	.027	.03	.118	.236
⅞	⅞	5.2	1.04	.42	.071	.031	.034	.136	.272
1	¾	5.6	1.12	.44	.076	.034	.034	.144	.288
1	⅞	6.7	1.34	.54	.091	.04	.04	.171	.342
1	1	7.8	1.56	.64	.11	.047	.044	.201	.402
1⅛	⅞	8.7	1.74	.61	.12	.11	.05	.28	.56
1⅛	1	10.	2	.70	.14	.12	.057	.317	.63
1⅛	1⅛	11.2	2.24	.74	.15	.134	.061	.345	.69
1¼	1	12.2	2.44	.91	.17	.146	.075	.391	.78
1¼	1⅛	13.8	2.76	.96	.19	.165	.079	.434	.87
1¼	1¼	15.3	3.06	1.03	.21	.184	.085	.479	.96
1½	1⅛	19.8	3.96	1.4	.27	.238	.115	.623	1.25
1½	1¼	22	4.4	1.5	.30	.264	.123	.687	1.37
1½	1½	26.5	5.3	1.7	.36	.318	.14	.818	1.63

(To be continued)

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Protective Coverings for Shipbuilding Purposes: Paints

By Horace Holden Thayer*

Continuation from the October issue of a series of articles containing information regarding shipbuilding materials and their uses that is not readily obtainable from shipbuilding handbooks and other generally available sources. The articles are not intended to be a complete exposition of the subject but will be found to contain items of value to the various classes of workers in this field who have to deal with these materials from the materials point of view.

SHELLAC as previously stated is gum shellac dissolved in alcohol. Navy Department specifications for clear shellac call for 6 pints 1 gill of grain alcohol and 2 pounds 6 ounces of orange gum shellac per gallon. Colors are obtained by the addition of dry pigments. For furniture the shellac is grade A, and for other work, grade B. Their specifications for the orange gum shellac embody the following requirements:

Grade A Quality

1. For pattern and varnish work.—To be of a grade similar in quality to the brand known commercially as "Double Triangle G," and must be friable by hand without the use of any tools. When treated with hot 95 percent alcohol, the residue of insoluble matter must not exceed 1¼ percent, and the shellac must be free from resin and other adulterants. All deliveries must be equal in color and in all other essential respects to the standard sample of this grade of shellac.

Grade B Quality

2. For coating linoleum-covered decks.—To be of good quality and must be friable by hand without the use of any tools. When treated with 95 percent hot alcohol, the residue of insoluble matter must not exceed 3 percent. It must be of one of the following two qualities: (1) Free from rosin and have an iodine number of less than 18 as determined by method of subcommittee on shellac analysis (Journal of the American Chemical Society, pages 1221 and 1227, Volume XXIX, No. 8, August, 1907); or (2), the grade known commercially as "U. S. S. A. Standard TN," containing not more than 3 percent rosin. The grade of shellac known as "New York Standard 3 percent" will not be accepted. Deliveries of resin-free shellac and "U. S. S. A. Standard TN" must in all essential respects be equal to their respective standard samples of these grades.

Grade C Quality—Garnetlac

3. Garnetlac for coating linoleum-covered decks.—To be of good quality and ground fine enough to be readily soluble in alcohol. When treated with 95 percent hot alcohol, the residue of insoluble matter must not exceed 1 percent. To be free from resin and have an iodine number of less than 18, as determined by method of subcommittee on shellac analysis, referred to above. All deliveries must be equal in all essential respects to the standard sample of this grade of shellac.

Bright Finish Work

A good standard of requirements for bright finish work in first class accommodations and similar spaces is as follows. The shellac is required to keep the stain or filler from coming through the varnish.

Poplar

1 coat linseed oil 25 percent, turpentine 75 percent
1 coat oil stain containing 50 percent turpentine
1 coat shellac
2 coats interior varnish

Other Woods

1 coat paste filler slightly darker than the natural wood
1 coat shellac
2 or 3 coats interior varnish

Hardwood Floors

1 coat paste filler
1 coat shellac
2 coats prepared floor wax

*Member of the firm of Rossell & Thayer, naval architects and marine engineers, Philadelphia, Pa.

Spreading Power

A knowledge of the spreading power of paint, varnish, etc., is of considerable value in determining the kind to use as well as in determining the amount necessary. Some high priced products are found to be cheaper than those of lower price when the comparative spreading power is taken into account.

Dr. A. H. Sabin, whose work has been referred to in the section of this article dealing with priming paints, figures that a pure red lead paint, mixed in the proportion of 28 pounds of dry red-lead to 1 gallon of pure linseed oil, without turpentine or other thinner, when applied to average new structural steel surfaces will cover from 500 to 700 square feet per gallon for the first coat, from 650 to 800 square feet for the second coat, and from 700 to 850 square feet for the third coat. Thus for a combined priming and second coat, 1 gallon of paint will cover from 300 to 400 square feet, and for three coats 1 gallon will be required for every 215 to 245 square feet. Paint made up with paste red lead is considered to have a greater spreading power than similar paint made from dry red lead.

When figuring for estimating purposes more conservative amounts are usually used. These for one coat will be around 200 square feet per gallon for bottom compositions and 300 square feet per gallon for all other paints, including the priming paint.

Approximate figures given by the Navy Department for the spreading rates of their paints are of value and those of greatest interest in connection with this article are here given:

	Square Feet
Hand mixed red lead	450
Anticorrosive-Norfolk No. 17	270
Antifouling-Norfolk No. 19	243
Boottopping, red	405
Boottopping, light gray	684
Outside white	486
Outside black	477
Spar color	495
Inside white	432
Flat white	540
White enamel	540
Spar color for smokestacks	333
Light gray for smokestacks	477
White canvas preservative	70
Under cork	135
Clear shellac	450
Red or yellow shellac	369

Paint Spraying

Of recent years the practice of applying such paints as priming paints and bottom compositions, and applying paints elsewhere where large surfaces are involved, with machines operated by compressed air, called paint guns, has become more and more prevalent. They are great labor and time savers as one machine will frequently do the work of five or more men.

Although the spraying machine manufacturers insist that it is not necessary to dilute the paints in order to apply them in this manner, this dilution is frequently practiced to the

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extent of materially impairing the protecting value of the paint.

PAINT COLORS

Some colors are not lasting under shipboard conditions and others are undesirable in certain locations on account of soiling readily, the general effect produced, or for other reasons. Color schedules that have been tried out and found to give good satisfaction are therefore of value, and such a schedule is here presented. The bottom compositions and boottopping would be of the standard colors for the compositions used.

BLACK

Outside of hull from L. W. L. to rail, when the boottopping is dark.
Fire room ventilators, coaming and cowls.
Deck machinery and foundations.
Steering engine.
Bitts, clocks, etc.
Anchors and hawse-pipes.
Stack.
Uptakes, etc.
Rigging fittings in way of black paint.
Deck fittings.

GRAY

Outside of hull from L. W. L. to rail, when the boottopping is gray.
Underside of decks in holds and 'tween decks.
Inside of poop, bridge and forecastle cargo and stores spaces.
Hold ventilators.

GREEN, LIGHT

Underside of deck over promenades.
Underside of deck over steering stations.
Underside of screens over windows.

LEAD COLOR

Canvas decks.
Hatch covers.
Cargo battens.

RED, BRIGHT

Inside of ventilator cowls.

RED, DARK

Topside of steel decks where painted.
Waterways.
Machinery foundations in engine rooms, etc.

RED, OXIDE

Sides of cargo holds and 'tween decks.
Inside of steel hatch coamings.
Outside of shaft tunnel.

SLATE COLOR

Boiler room.
Engine room dado to 3 feet above the working platform.
Shaft tunnel dado to 3 feet above the working platform.

SPAR COLOR

Outside of superstructure below grab rail.
Outside of hatch coamings.
Low skylights.
Masts.
Outside of hold and engine room ventilator coamings and cowls.
Propelling machinery and auxiliaries.
Ice machines.

WHITE

Outside of poop, bridge and forecastle above rail.
Outside of superstructure generally above grab rail.
Exposed woodwork generally except decks, machinery foundations and hatch covers.
Partitions in quarters, etc.
High skylights.
Companions.
Ice machine room.
Dynamo room.
Engine room above 3 feet high dado.
Inside of engine and boiler casings.
Engine room ventilators.
Inside of shaft tunnel above 3 feet high dado.
Ridge poles and spreaders.
Rails and stanchions.
Flag poles.
Boats and davits.
Life rafts.
Rigging fittings in way of white paint.
Small canvas covers for binnacles, rope reels, ventilator caps, etc., waterproofed.
Binnacles, if not natural or bright finish.
Ship's name.

The Navy Department has formulated a color scheme for piping which is of great value in enabling the ready determination of the service of the piping, and this system has been largely adopted in merchant practice. Their specifications for this are:

Standard Coloring for Piping.—All voice pipes shall be painted the shade and color of the surrounding surfaces. The body color of all pipes or pipe covering, exclusive of pneumatic piping, which shall be painted in its distinctive color throughout, shall conform in shade and color to that of the surrounding surfaces, except on edges and side of flanges, where the distinctive colors shown in the following sketch shall be painted. The edges of flanges of fuel oil filling pipes, down to the tank, when no manifold is fitted, shall be painted the same color as delivery pipes, *i. e.*, red. Where a pipe has no flanges, the couplings and elbows shall be painted as per standard at flanges. Where a pipe has neither flanges nor couplings, a circumferential band, or bands, containing the distinctive colors, shall be painted at suitable intervals. No compartment shall be left with pipes unmarked.

The sketch referred to shows the color around the flanges and the color of bands painted on the pipes about one inch away from the flanges. The following schedule gives the same data. The bands are 4 inches wide unless otherwise stated:

		Flanges	*Bands*
Steam piping	Supply	Black	White
	Exhaust	Red	White
Salt water piping	Suction	Black	Green
	Delivery	Red	Green
Fresh water piping	Suction	Black	Lead color
	Delivery	Red	Lead color
Hydraulic piping	Supply	Black	Blue
	Exhaust	Red	Blue
Ventilation piping	Supply	Black	Yellow
	Exhaust	Red	Yellow
Fuel oil piping	Suction	Black	Red (2″), white (2″), red (2″)
	Delivery	Red	Red (2″), white (2″), red (2″)
	Both services	1 Black, 1 red	Red (2″), white (2″), red (2″)
Drains, scuppers, air pipes, sounding pipes		White	White
Fire main		Red	Red
Flooding pipes for magazines, peak tanks, etc.		White	White with red lengthwise stripe
Pneumatic piping		Black	Black (continuous)
Air-water ejecting system		Black	Red (2″ next flange) Black (next 6″)
Carbon dioxide fire extinguishing system		Black	White (2″ next flange) Black (next 6″)
Refrigerated water piping		Red	Lead color with 2 white squares
Hot water piping		Red	Lead color with white lengthwise stripe

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CONSUMABLE STORES

Paints carried for the painting of topsides by the crew, and other work about the vessel, should be in conformity with those previously applied. A good selection of engineers' consumable stores for the general run of merchant ships is as follows:

	Quantity
Asphaltum, black	5 gallons
Brown, metallic, ground in oil	25 pounds
Graphite (amorphous) in 5-pound cans	10 pounds
Japan drier	2 gallons
Lamp black	2 pounds
Linseed oil, boiled and raw	20 gallons
Litharge, for ammonia joints or as drier	5 pounds
Prussian blue, for bearings and gears	1 pound
Red lead, dry, in 25-pound kegs	100 pounds
White lead, in oil, in 25-pound kegs	50 pounds
Turpentine	10 gallons

Insurance Companies Seek Settlement for War Losses

Claims Allowed by Washington Commission Against Germany Will Be Awarded to War Risk Insurance Companies Who Paid Losses on American Ships

By "Bordereaux"

THE most interesting, though not the most unexpected, occurrence in marine insurance during the past few weeks has been the denial by the Mixed Claims Commission, sitting at Washington, of the demand of Americans for the recovery from Germany of amounts paid by them for war risk insurance during and immediately after the World War. This outcome of an unjustifiable desire to get something for nothing out of the Teutons has repeatedly been predicted in this department of MARINE ENGINEERING AND SHIPPING AGE. The underwriters were not out anything, because they had accepted the hazard and been content with the extra remuneration received by them; nor were the shippers in position to pose as claimants, because they had long since passed the extra cost along to their consumers. Nevertheless, there was a great rush to try and get something out of Germany, the total running into hundreds of millions.

The Commission has still to rule upon the various claims for damage to or destruction of property of American nationals by Germany and her allies; and under this classification will come the claims for ships and goods lost by the sinking of ships by submarines, mines and otherwise. When claims are allowed for the loss of property by Americans, and the owners of such property have already been indemnified for their losses by war risk insurance companies, the latter will figure as assignees of such claims under the subrogation they took when they paid the claims, and it is the expectation of the underwriters that in such cases the claims will be paid to them under such subrogation agreements.

In passing adversely upon the claims for refund of war risk premiums, the Commission stated its conclusions as follows: "It is evident that during the period of neutrality both groups of belligerents freely resorted to 'retaliatory measures,' to the detriment of all neutral commerce, over the vigorous and repeated protests of the Government of the United States; and in both theory and practice, as demonstrated by actual experience, the American nationals insured against the risks created by the acts of both groups, risks inevitably incident to the very existence of a state of war. Obviously it is impossible, therefore, to attribute these risks to the acts of Germany without holding her liable for all the consequences of the war, which, under the treaty, is not permissible. In this group of claims there is no complaint of injury to or destruction or seizure of property by the act of Germany or her agents. The sole complaint is that the hazards of war required the claimants as a matter of business prudence to protect by insurance against risks which never matured into damage to or destruction of the property insured, and the claimants seek to recover from Germany the cost to them of such insurance."

Hull Insurance Unsatisfactory

STUDENTS of marine insurance in Great Britain have been making approximate surveys of the progress of hull underwriting in 1923 and they are unanimous in declaring that rates are too low, conditions too liberal, and that there is urgent need of a closer agreement among underwriters for their own protection. Throughout the year the decline in both hull and cargo rates has been steady, even to the point of absurdity; and that in the face of a more than normally heavy loss experience. There is the slimmest chance of underwriting profit this year.

A dependable authority states that losses of British steamers which in tonnage were greater in 1922 than in 1921, are above the 1921 total, and are likely to exceed the 1922 total with average losses to the end of the year. American steamer losses, which in 1922 were below those of 1921, reached the 1921 total before the end of October. Taking underwriting figures on steamers for time on Institute clauses, *Fairplay* insists that it will be found that the 1922 account is running off with a considerably greater loss than the 1921 account at the same period, and that there is every probability of 1923 going badly also. The fact that, owing to the low freight rates obtainable, only the better class of boats has been employed is, naturally, in favor of the underwriters. Experience during the present year has led underwriters to discount the familiar contention that the marine hazard has been reduced because of the various improvements in navigation.

Repair costs are not coming down. An American underwriter informed a friend recently that on one of his risks the repair of a crankshaft involved a cost equal to one-half the insured value of the steamer. In Great Britain the hull business is the important end of the market to the underwriter. In the United States it is the reverse, as Americans have never been keen over hull lines.

London has gone after American hull business in the most deadly earnest, quoting rates that made competition on this side impossible. Secure in the holding of their English business they have been offered quotations for American vessels at substantially lower figures than they accorded their own nationals. Then, when they had corralled everything in sight over here, they got together, last September, and decided to abandon cut-rate methods and stand out for the maintenance of rates and conditions at a fair figure. In this apparently desirable action they invited the defeated American underwriters to join in locking the barn after the horse had been stolen. If London is now discovering that an underwriting loss lies ahead of them it does not come to

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the American underwriters as a surprise. The famed British "world spread" will have to help London out of its hole.

On-Deck Stowage

FALL and early winter storms on the Atlantic have been bringing their usual quota of losses and considerably more this year. Under such circumstances it has been only natural that cargo stowed on deck should have suffered in proportion, and underwriters have been watching this class of business with keen eyes. It is one of the fundamental principles of marine insurance that cargo shall be stowed in accordance with the recognized rules of shipping and in most cases this means below deck. The responsibility for violation of this rule may involve the shipowner and operator and it is essential that these interests be acquainted with the rules and regulations of the trade. In issuing the usual form of basic cargo policy, where no mention is made of the place of stowage of the cargo, the underwriter is protected against the possibility of loading on deck cargo which is customarily loaded under deck.

If a vessel owner gives a clean receipt for ordinary cargo the cargo must be stowed under deck and if it is loaded on deck the vessel owner does so at his own risk. In such an instance the basic form of marine policy would not attach on goods, as the merchandise was not stowed in the customary place for the carriage of such cargo. Should damage to the cargo eventuate, the owners would be compelled to look to the vessel owner for reimbursement. Acids and other highly dangerous commodities are, in many instances, required by law to be carried on deck. Therefore, even though the assured neglects to state that such goods are actually laden on deck, the underwriter would be liable, if so laden, without notice.

Lumber is frequently insured on deck, subject to regular f.p.a. conditions, but it is difficult to insure acid except free of claim for damage but including loss by washing overboard or jettison. The ordinary on-deck rate varies from two to five times the under-deck, depending upon the type of cargo and the length of the voyage.

Under the York-Antwerp rules, on-deck cargo contributes in general average, but is not contributed for. It is easy to understand the reason for this rule if one considers that jettison of cargo for the benefit of all interests is customarily made good as a general average sacrifice, and on-deck cargo would, in almost all cases of stress, be thrown overboard immediately as a precautionary measure, thus subjecting the under-deck cargo to a charge which is due more to the manner of the stowage than to its being a sacrificial measure. On the other hand there is no reason why on-deck cargo should not contribute in general average if expenses or losses are incurred from which the on-deck cargo benefits. The ordinary on-deck insurance includes coverage against general average and salvage charges.

The danger of on-deck cargo breaking adrift, and its susceptibility to loss or damage because of its exposed position, makes it necessary that strict rules be made for the proper stowage of such cargo. And that is why we find that underwriting boards lay down specific methods for loading and securing deck-laden goods.

Deviation Permit

THE following clause is now being used by the United States Shipping Board in its bills of lading:

"If vessel be prevented from reaching her destination by quarantine, shallow water, blockade, conditions of weather, surf, ice, war or civil disturbances; or, if it becomes impracticable to discharge the goods at destination on account of congestion, strike, labor difficulties, or otherwise, occurring before or after receipt of goods by the carrier, vessel shall have liberty, without proceeding to or near port of destination, to proceed to and discharge the goods at a nearby available strike free, uncongested port. Notice of discharge of the goods shall be dispatched to consignee, if named herein, otherwise to the shipper, and such discharge shall be deemed a complete delivery under this contract and full freight shall be deemed earned. All expenses incurred on the goods shall be a lien thereon."

This is all very nice, but there is an insurance angle to it that ought not be overlooked. The ordinary marine policy contains a clause excluding the risk of strike and riot, and the insurance might well be invalidated by the operation of the clause above given, which grants the privilege to the carrier in event of congestion at one port to discharge at a nearby port. Despite the deviation clause of the marine policy, if the deviation is caused by some such reason as a strike, which is expressly excluded from the policy, the underwriters in all probability would not be liable during the period of deviation.

Coffee Cargo Swelled

THE Pacific Mail steamer *Cuba* which went ashore in the Pacific off San Miguel Island a month or two ago was finally abandoned with a loss of $400,000. A peculiar thing about this casualty is that the cargo of coffee swelled greatly through action of the water. Underwriters have had frequent experience of damage to vessels due to the swelling of grain cargo but it is rare indeed for such damage to be caused by the swelling of coffee. Three or four years ago a case was reported where the seams of a wooden schooner bound from Brazil to New York were opened by this cause, but that was the first case of the kind of which there was any knowledge. It is now claimed that the destruction of the *Cuba* was not owing so much to the pounding of the waves as to the swelling of the cargo of coffee which caused the hull and decks to be forced out of line.

Pilferage Bureau Popular

MARINE insurance men at New York have faith in the success of the proposed Pilferage Information Bureau, provided that all who now profess interest in its organization will adequately support it after it has been started. They believe it will aid materially in controlling and reducing theft and pilferage losses at this port. The underwriters have been represented at the meetings of the provisional committee and one of them, H. H. Reed, is a member of that committee which, as is known, has been invited to continue its work and draft by-laws and nominate officers in order that the Bureau may become a concrete fact and begin to function at the earliest possible moment. Through such a clearing house, insurance and shipping interests, it is believed, could secure the maximum amount of information for the tracing and punishment of cargo thieves. It is not planned to employ either watchmen or detectives, but merely clerks who shall assemble and classify the information turned in by Bureau members or from any other source. Every report of a theft is to be forwarded immediately to each member and thus solidify a strong and organized support behind the movement.

Report on Talin (Reval)

A DIGEST of information on the port of Reval has been prepared by the Board of Underwriters of New York, in which the following interesting data appear: Vessels drawing thirty feet can pass in and out. No tide. The total length of the berthing space is about 7,800 lineal feet, the depth along the quays being from 18 to 30 feet. All quays are provided with normal gage railway, and two quays are provided with a narrow gage railway in addition. Cargo

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U. S. S. West Virginia Goes Into Commission This Month

Last of the Electrically Driven Battleships Completed at Newport News —Propelling Machinery Supplied by the General Electric Company

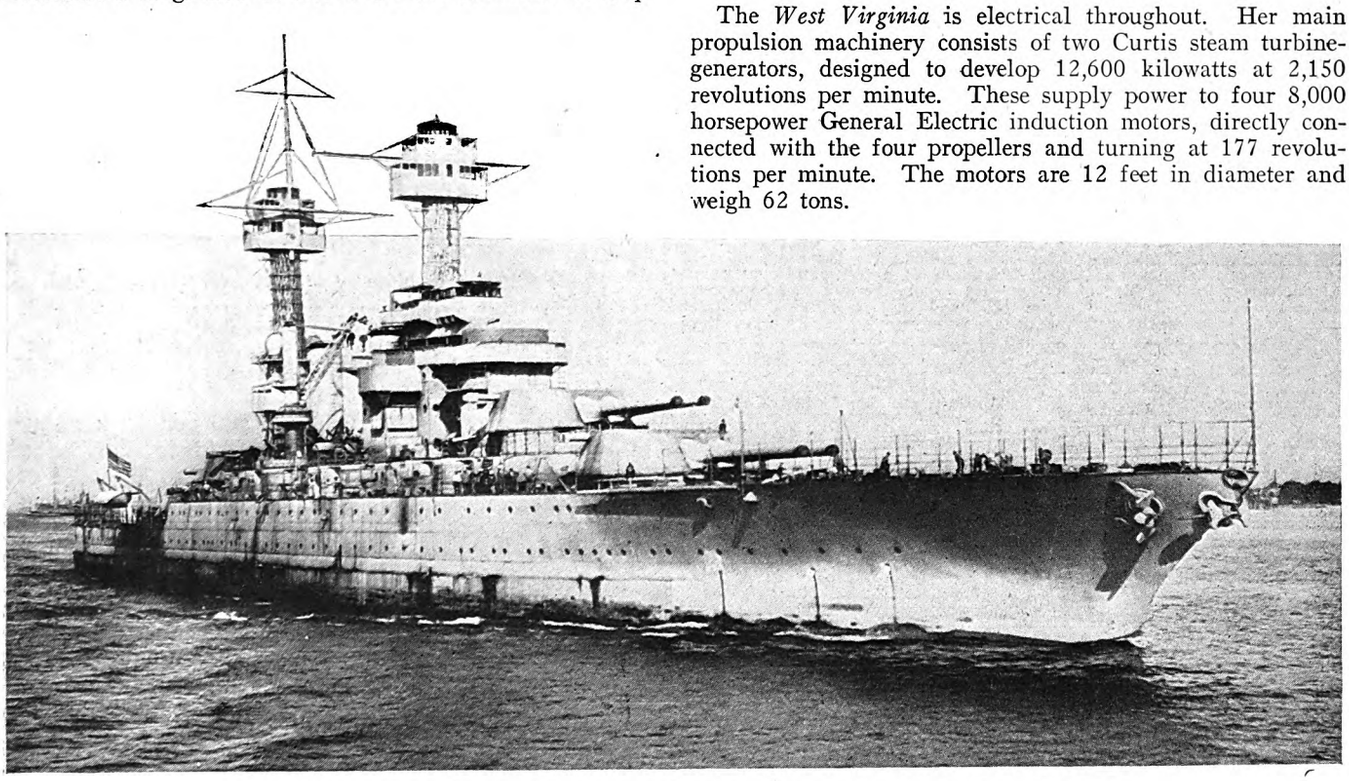
THE *West Virginia,* last of the battleships to be built by the United States Government under the Washington Arms Conference limitation and sixth to be equipped with electric drive, will leave the yards of the Newport News Shipbuilding and Dry Dock Company about December 1 to go into service under the command of Captain Thomas J. Senn. She will be a sister ship to the *Maryland* and the *Colorado.*

Carrying eight 16-inch guns, the *West Virginia* will be the most powerful fighting craft in the world. She will have a secondary battery of fourteen 5-inch guns, four 3-inch anti-aircraft guns and two underwater 21-inch torpedo tubes.

The vessel is 624 feet long, 97 feet beam at the waterline, and displaces 32,600 tons. She is expected to make 21 knots and has a cruising radius of about 10,000 miles. She will burn oil, her fuel capacity being about 1,400,000 gallons.

Electrical Machinery

The *West Virginia* is electrical throughout. Her main propulsion machinery consists of two Curtis steam turbine-generators, designed to develop 12,600 kilowatts at 2,150 revolutions per minute. These supply power to four 8,000 horsepower General Electric induction motors, directly connected with the four propellers and turning at 177 revolutions per minute. The motors are 12 feet in diameter and weigh 62 tons.



U. S. S. West Virginia, the Last of the American Battleships to Be Commissioned

The two turbine generators, supplied with steam generated by eight oil-burning boilers, can be run independently. Either is capable of driving the ship up to a speed of about 17 knots. The power generated by them is used for no other purpose than propulsion, electrical current for other needs being generated by six 300-kilowatt generators and two 400-kilowatt Diesel generators.

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can be loaded or discharged directly from the vessel into railway trucks, or vice versa. For lifting heavy cargo five floating steam cranes are available.

Failure of Condenser Tubes

(*Continued from page 773*)

be quite confidently stated that no facts whatever supported by any records of experience exist by which the observable or measurable properties of a condenser tube beyond those incident to good workmanship can be predictably related to its service endurance. The effect of such specifications, therefore, can only be to increase the ultimate cost of condensations. The American Society for Testing Materials has adopted specifications which it is believed comprehensively cover all the requirements of the best manufacturing practice and their unanimous acceptance by both producers and consumers alike could have no other result than to bestow on the industry all of the benefits incident to the introduction of standards into a situation in which they have had no previous existence.

In conclusion the writer wishes to point out the desirability of and necessity for a thorough investigation of condensers and the conditions under which they are operated as a means of providing data looking to the solution of the problem of tube failure. If in the presence of adequate records of temperatures, water velocities, shut downs, cleaning procedure, etc., failed tubes are withdrawn as they give out and the character of corrosive action involved in each case determined, much more progress will be made than through any amount of speculation based upon the physical and other properties of the tubes themselves.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Figuring Indicated Horsepower of Compound Engine

Q. (1,218).—Referring to Q. (1,198) in the June issue: "How to calculate Indicated Horsepower when Mean Pressure of Cylinders Are Unknown" refers to a three-cylinder triple-expansion engine. Could the same quantities be used for calculating the indicated horsepower of a two-cylinder compound engine except for the value of E? or—How could the indicated horsepower of a two-cylinder compound engine be found without knowing the mean effective pressures in the cylinders?
Diameter high pressure cylinder 17¾ inches or 18 inches;
Diameter low pressure cylinder 38 inches;
Stroke, 28 inches;
Revolutions per minute, 90;
Steam pressure, 175 pounds per square inch; vacuum, 24 inches.

A. (1,218).—Use the same nomenclature as in the answer to Q. (1,198) in the June issue.

$C_h = 60$ percent. This value has been assumed and varies from 50 to 70 percent for this type of engine.

$A_h = 247.5$ square inches.

$A_1 = 1{,}134$ square inches.

$$R = \frac{A_1}{C_h \times A_h} = \frac{1{,}134}{.60 \times 247.5} = 7.638$$

Hyp. log R = 2.0331.

P = 175 pounds absolute. This allows for 15 pounds drop between the boiler and engine steam chest.

L = 2.33 feet.

R.P.M. = 90.

S = 419.4.

p = 5 pounds. This value should be about 2 pounds higher than that corresponding to vacuum. It would have been better in my answer to question (1,198) to have used 4 pounds instead of 3.

$$P_m = P \times \frac{1 + \text{hyp. log } R}{R} - p = 175 \times \frac{1 + 2.0331}{7.638} - 5 = 64.5$$

E = .60 to .67 for this type of engine. Use .635.

$P_r = P_m \times E = 64.5 \times .635 = 41.$

$$\text{I.H.P.} = \frac{P_r \times S \times A_1}{33{,}000} = \frac{41 \times 419.4 \times 1{,}134}{33{,}000} = 591.$$

Fit of Propeller on Shaft

Q. (1,226).—Should a propeller be set up hard on the shaft taper or made an easy fit (secured with key and nut) for convenience in removal?
MACHINIST.

A. (1,226).—A propeller should be set up hard on the shaft taper, either by driving on or by the use of a sledging wrench, depending upon the size of the job, to guard against danger of backing off and to relieve the load on the propeller key. A propeller becoming loose on its shaft, even though the nut was locked, would soon batter the key to pieces. In naval practice, contractors are required to furnish propeller sledging wrenches.

Propellers as a rule are drilled and tapped for strongback bolts for use in pulling them off.

Strength of Boiler Water Gage Glass

Q. (1,227).—Why doesn't the water gage glass on a boiler burst from the pressure of the steam? J. W. D.

A. (1,227).—The stress per square inch on a gage glass due to the pressure alone is low, as will be seen from the following:

Inside diameter of glass ..... ½ inch
Thickness of glass ..... 7/64 inch
Boiler pressure, pounds per square inch gage..... 200

$$\text{Stress per square inch on glass} = \frac{200 \times .5}{.1094 \times 2} = 457$$

Assuming a tensile strength of 3,500 pounds per square inch gives a factor of safety of 7.66. This is a larger factor than the 4 to 4.5 usually allowed for Scotch boiler construction. It will therefore be seen that the glass from a boiler pressure standpoint is stronger than the boiler. There are, however, other factors entering into the manufacture of gage glasses which must not be neglected such as resistance against sudden temperature changes due to cold air coming in contact with the hot glass; and corrosion of glass due to steam, feed water and boiler compounds. Strains are often set up in the glasses, which can not be taken care of by calculations, due to misalinements of glass and fittings when assembling.

Influence of Ash in Coal on Boiler Efficiency

Q. (1,225).—What is the influence of the percentage of ashes in coal on the boiler efficiency? O. K.

A. (1,225).—There are two methods of figuring boiler efficiency:

1. Efficiency of the boiler =

$$\frac{\text{Heat absorbed by boiler per pound of combustible}}{\text{Calorific value of one pound of combustible}}$$

2. Efficiency of boiler, furnace and grate =

$$\frac{\text{Heat absorbed by boiler per pound of coal}}{\text{Calorific value of one pound of coal}}$$

The first is based upon the combustible content of the coal and is preferable as a standard of comparison for all tests as well as being the one usually understood when boiler efficiency is referred to. The second is based upon dry coal and permits of comparison of the combined boiler, furnace and grate performance.

Ash consists of the non-combustible residue left after complete combustion has taken place. It not only is waste material in the coal but it carries away with it a considerable amount of unburned carbon when cleaning fires. The amount of ash in a coal is extremely important to know because of the effect of its fusibility upon the steaming quality of the

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coal. As the ashes fuse, clinkers are formed on the grate which together with the unfused ashes clog the grate, cutting off the air supply to the fire thus necessitating frequent cleaning and retarding combustion to such an extent that the boiler efficiency becomes rapidly impaired.

It may be seen from the foregoing that while the calorific value of coal is decreased by the presence of ash and though the heat absorbed by the boiler per pound of coal is theoretically decreased probably in the same proportion, yet in reality as the percentage of ash is increased, its heating value decreases in more rapid proportion thus lowering the boiler's combined efficiency.

LETTERS TO THE EDITOR

Weight of Engines in M. S. Crux

TO THE EDITOR: COPENHAGEN, Denmark.

We have studied the article "Europe Developing New Types of Diesel Engines" in your October issue with much interest, and note the statement that the less weight of the machinery of M. S. *Crux* is only achieved by adopting "the high speed of 145 to 150 revolutions per minute."

We cannot admit you are right and only draw your attention to the fact that the same number of revolutions was used in several of our older motorships as M. S. *Suecia,* M. S. *Pedro Christophersen,* M. S. *Arator,* etc., where the weight of the machinery was considerably greater than for the M. S. *Crux.*

According to our experience this number of revolutions has always proved suitable in the ships where it has been used.

AKTIESELSKABET
BURMEISTER & WAINS,
MASKIN-OG SKIBSBYGGERI.

Cooperation Between Owner, Builder and Operating Personnel

NEW YORK, N. Y.

TO THE EDITOR:

At the present time we hear much about the high cost of operating American ships, and the importance of saving "here and there." Much is expected of the marine officer in the accomplishment of this desired end. As a general rule, the officer does all he can and is fully alive to this important matter. He is only too anxious to cooperate with the owner, as it means his very bread and butter in plain words.

If the owner claims a handicap, and no doubt he does, when comparing with certain European standards, the ship's officers are also put under a handicap by their unskilled and ever-changing crews. They have continuously to teach green crews and very seldom realize a fair return on their investment as the men generally don't stay long enough on a ship to master the profession thoroughly or to be of any material help and assistance. Men nowadays don't seem to realize the importance of learning a trade thoroughly nor to have the patience to do so. It is a rarity to find a mechanic of any trade among the crew or even among the engineers. Again the relations of the ship's personnel and officers are not always of the best; in some cases amounting to open hostility. Often a senior officer is blamed for every little mistake made by those under his charge, and long years of service and loyalty are rewarded by a dismissal after spending the best part of his life in a firm's employ. A lot could be done, if officers and their employers could get better acquainted and meet each other halfway. Loyalty begets loyalty and it is the human factor, after all, that decides profit and loss in any line of business.

Secondly, there is a great field for improvement in designing and installing the various auxiliaries of the ship's power plant, whereby the cost of upkeep would be materially lessened and at sea made easier. If auxiliaries were only installed in accessible places, it would not be necessary, as is too often the case, to dismantle about half the engine room in order to remake some pipe joint. It is only a matter of using the allotted space to the best advantage instead of shoving everything in one corner and wasting the other. A good many ships have a fairly complete machine shop to take care of routine work, but often in such a place that it is almost impossible for a man to work there on account of abnormal heat and poor ventilation, so really, considering the cost of installation, it becomes a liability instead of an asset.

There is a great field for improvement in the merchant marine—above all in closer cooperation and good will between owner, builder and operating personnel to the mutual benefit of all concerned.

New York. MARINE ENGINEER.

NEW BOOKS

The Lookoutman

Reviewed by Carl E. Petersen
Naval Architect, United States Lines

THE LOOKOUTMAN. By Captain David W. Bone. Size, 8¼ by 6 inches. Pages 220. Illustrations, 22. New York, 1923: Harcourt, Brace & Company.

To those who "go down to the sea in ships" or who are otherwise engaged in the design, building or operating of ships, the latest book, "The Lookoutman," by Captain David W. Bone, master of the Cunard liner *Tuscania* will instantly appeal. While the book is primarily intended to familiarize the layman with the general types comprising the present day tonnage it is so full of information concerning these types, their functions and their behavior at sea that no technical man who loves his profession should miss an opportunity to read it.

The book consists of fourteen chapters: 1, "Getting Under Way"; 2, "The Great Ships"; 3, "Mail Liners"; 4, "Intermediate and Cargo Liners"; 6, "Tramp Steamers"; 7, "Turret Ships and Oil Tankers"; 8, "Steam Yachts and Cross-Channel Express Steamers"; 9, "Coasters and Short-Sea Traders"; 10, "Fishing Craft"; 11, "Pleasure Steamers"; 12, "Dredgers and Attendant Craft"; 13, "Tugs and Port-Service Vessels"; 14, "Piping Down," and "Glossary of Sea Terms." The book is well illustrated with sketches and small scale silhouette profiles. There is also appended a splendid glossary of sea terms for the uninitiated.

Perhaps no other recent author has explained the sentient bond existing between man and ship as has Captain Bone in his introduction, which reads as follows:

"The attitude of the sailor toward the ship is sufficiently peculiar to call for comment. To him, a seaworthy vessel is quite unlike any other structure fashioned by man. He sees her as a sentient creature with a decided personality; a spirited rover of wide seas, possessing qualities no less resourceful and adventurous than his own; a creature to be humored and admired (or perhaps forced and cursed) as her tricks and moods and tempers become revealed to him. For this belief, the circumstances of her birth are sufficient warrant. Conceived in the studious and creative mind of her designer, erected in patient exactitude by her builders, trimmed and riveted and fashioned into a complete and wonderful whole by the skill and craftsmanship of her artisans, she comes to her sea world with sponsors and guarantors enough. Surely, some intangible essence, some spirit of all these labors at her birth—the conceptive thought, skilled direction, the sweat and strain of toiling hammermen—must pass into her shapely hull as it grows upon the stocks. And when, at length, she is named and launched and floats upon the

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river reach—a noble vessel, powerful, buoyant, inspired by the stir and circumstance of her baptism—the cheering shipyard workers must feel that a part of themselves goes out abroad with this wonderful product of their hands. It is this conception of personality and character in a ship that the sailor accepts. He may call her brute or lover, he may beat and drive her or handle her with tender care, but she is never a senseless machine to him. The reader is entreated to tolerate this simple faith."

In the second chapter listing the ten great liners or "Sea Queens" are included our own *Leviathan* and *George Washington.* The other vessels named, the *Majestic, Berengaria, Olympic, Homeric, Aquitania, Mauretania, Paris* and *Belgenland,* together with our own are chosen "not merely because of their great size, but rather by virtue of the completeness and safety of their performance."

A noteworthy statement which designers of vessels may well bear in mind is—"It is a fact, peculiar and perhaps unaccountable, that the most graceful ships are the most sea kindly in a gale."

Regarding the mail liners as apart from the leviathans of the ocean, Captain Bone has this to say: "As it seems unlikely that any new ships of the greater class will be laid down in the near future, the mail liners may be looked upon as the heirs apparent to the maritime thrones of the nations." The author makes the following remarks on the 535-footers:

"At a first glance, one is inclined to dismiss her as unworthy of sailorlike attention; she appears to be unnecessarily odd in her proportions; her peculiar features are aggressively at variance with all the accepted standards of a fine ship design. But such a view would be unfair to an excellent, if unorthodox, intermediate liner. She is distinctly a product of the war, and German submarines are to be blamed for her departures from the symmetry of conventional ship architecture. If she could be seen from the point of view of her designer, who was concerned to present a distorted outline to the periscopic survey of an enemy submarine commander, one would doubtless form a better and more kindly estimate of the skill with which this requirement, at least, has been met. She was originally built as one of a transport fleet for the carriage of United States troops, but these vessels were not completed when the war ended. When under construction, she was converted into a cargo carrier of large capacity with very fine accommodations for a comparatively limited number of passengers. One of her peculiar (war-time) features is the form of the stern, an ingenious copy of the bow structure of the ship, and one which, together with the upright setting of masts and funnels, made it very difficult for a distant observer to determine whether she was bound east or west. But for this arrangement (which one would hesitate to term seemly) her hull has fine lines and the great flare of the bows is particularly noticeable. Her passenger accommodation is in a box-like superstructure amidships and is perhaps more ample and convenient than that of vessels having more graceful and less rectangular deck erections. She has a speed of about fifteen knots (speed erroneously stated, should be 18 to 19 knots) and is altogether a strong and seaworthy vessel."

At the present time with very much depressed shipping conditions in this country, full significance should be taken of the author's statement:

"The laying down of the great emergency fleet, * * * * * was a new adventure for Uncle Sam. For years he had been lying on his oars, content to let other nations do his 'trucking.' In competition with the cheaper workmanship, cheaper materials, cheaper manning, of other maritime nations, he could see little or no profit in an adventure on the deep. Came the war, and the perspective of his vision altered rudely. The film of 'profit and loss' dissolved, showing *the ships as one of the great material assets of a nation.* The cry was for ships, for ships at any price! Much can be done when costs are in the clouds, when all considerations of profit are blown over the horizon before the blast of war. The tremendous augmentation of American tonnage that astonished the world and did so much to end the war came when Uncle Sam put aside his 'landward' toys and commenced to ply the oar again."

The "oil tanker" is considered by the author as being probably the nearest approach to the unsinkable ship that has yet been conceived by the naval architect, and in her he has designed a ship that combines great stability and power, excellent speed and ease of maneuver, with a capacity to carry a large burden.

Finally the book is highly informative and very interesting and the author is to be commended on the pleasing manner in which he has presented a broad and varied subject.

DIESEL AND OIL ENGINE HAND BOOK. By Julius Rosbloom. Size, 5½ by 7 inches. Pages, 376. Numerous illustrations. Los Angeles, Cal., 1923: The Technical Publishing Company.

This book is a compilation of a quantity of more or less disconnected data relative to Diesel and oil engines, together with some very short and elementary explanations of the principles of thermodynamics, indicator practice and electrical measurements. The main value of the book is embodied in a considerable amount of information, in the form of questions and answers, relative to the operation of internal combustion engines.

PERSONAL MENTION

H. H. BENEDICT, formerly traffic manager of the Green Star Steamship Corporation, is now New England agent of the Pacific Mail Steamship Company.

CHARLES MACGREGOR has left the Shipping Board staff at 45 Broadway, New York, and returned to his old connection with the Export Steamship Company.

W. S. WILKENSON, technical manager for some time past at the New York office of the Bethlehem Shipbuilding Corporation, has been transferred to the Moore plant at Elizabethport, N. J.

HERBERT N. THOMAS, formerly manager of China Mail Steamship Company, is now on the staff of the Robert Dollar Company, under Hugh McKenzie, head of the passenger department. Prior to joining the China Mail, Mr. Thomas was with the Pacific Mail Steamship Company.

F. B. WEBSTER, who recently resigned the position of editor of MARINE ENGINEERING AND SHIPPING AGE to become business manager of *The Marine Journal,* is a graduate of the Massachusetts Institute of Technology of the class of 1901 in naval architecture and marine engineering. Mr. Webster began his career as a ship fitter in the yard of the Fore River Ship and Engine Company, which is now a part of the Bethlehem Shipbuilding Corporation, Ltd. He worked in the drafting rooms of the Puget Sound Navy Yard, the Moran Company and the Seattle Dry Dock and Construction Company until early in 1914, when he went to the Bureau of Construction and Repair, Navy Department, Washington, D. C., to take a position in the research and scientific department. He resigned from this position in 1917 to become naval architect for the Liberty Shipbuilding Company and subsequently naval architect and chief designing engineer for the Concrete Ship Section of the Emergency Fleet Corporation. After the armistice Mr. Webster compiled the "Shipbuilding Cyclopedia" for the Simmons-Boardman Publishing Company, subsequently becoming editor of MARINE ENGINEERING AND SHIPPING AGE.

F. B. Webster

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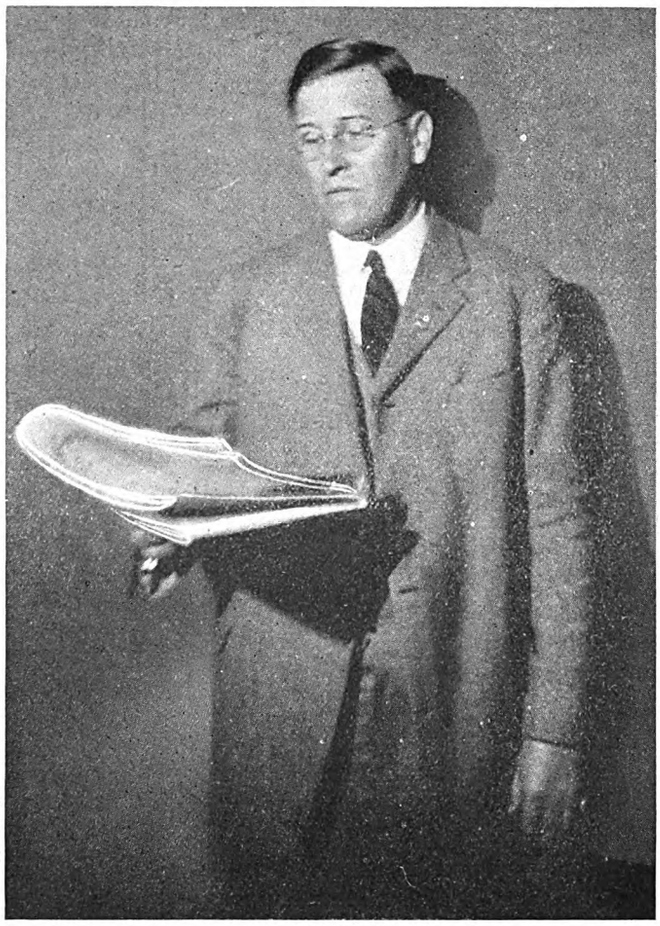
Frank J. Shipman, President, American Marine Association

Marine Association Elects Officers for the Coming Year

ON Saturday, November 10, the annual meeting of the American Marine Association was held in the Waldorf-Astoria Hotel, New York City. Frank J. Shipman, of the Texas Company, was elected president for the coming year, succeeding Colonel E. A. Simmons. The other officers elected were: Vice-president, Edward A. Colson, Babcock & Wilcox Company; treasurer, James Plummer, Newport News Shipbuilding Company.

The members of the executive committee are: H. F. Alexander, Pacific Steamship Company, Seattle; S. I. Cooper, Southern Pacific Company, New York; James S. Milne, Todd Shipbuilding Corporation, New York; Colonel Edward A. Simmons, Simmons-Boardman Publishing Company, New York; A. E. Allen, Westinghouse Electric & Manufacturing Company, New York; W. M. MacFarland, Babcock & Wilcox Company, New York; W. E. Sawhill, editor *Marine Review*, Cleveland; Captain W. H. Stayton, Baltimore Steamship Company, Baltimore.

The executive committee will meet later and select a secretary to succeed K. Warren Heinrich, who has resigned, effective December 1.



Edward A. Colson, Vice-President, American Marine Association

D. G. HODGES has been appointed assistant to the general manager of the Alabama Dry Dock & Shipbuilding Company of Mobile.

R. T. GORDON has been appointed New York district manager of Dean Brothers Company of Indianapolis, manufacturers of pumping equipment.

J. M. HARTMAN, in charge of docks and wharves for the Shipping Board, has resigned, effective December 1, to become general manager of the Boston Tidewater Terminal Company.

RALPH L. LOVELL, formerly chief engineer for the Emergency Fleet Corporation, has been appointed a sales engineer for the Power Specialty Company, handling Foster superheaters and watertube boilers.

EDWARD HANNA, formerly vice-president and general manager of the Hanlon Shipbuilding & Dry Dock Company of Oakland, Cal., recently became manager of the Bethlehem Shipbuilding Plant at San Francisco.

HARRY MEACHEM, formerly New York representative for the Dean Bros. Pump Company, has been appointed vice-president and general manager of the Rider-Ericsson Engine Corporation and the Delamater Iron Works.

F. J. O'CONNOR, of the Donovan Lumber Company, was elected president of the Shipowners' Association of the Pacific Coast, succeeding R. W. Myers of the Hobbs-Wall Lumber Company, at the annual election of officers.

GEORGE O. WALTON, who has been in the steamship and railroad business for many years, has been appointed district passenger manager of the United States Lines, in charge of the territory comprising New York State, southern Connecticut and New Jersey north of Trenton.

CAPTAIN ELMER E. CROWLEY, formerly of the Coastwise Transportation Company of Boston, has been appointed general manager of the Susquehanna Line, Inc., 2 Stone street, New York, to succeed J. B. Austin, Jr., deceased. Captain Crowley has been one of the most active and successful of New England steamship executives.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Catalina Island Line to Build New Passenger Steamer

THE Wilmington Transportation Company, operators of the Catalina Island line of steamers plying between Los Angeles and Avalon, has decided to build a new boat for this service, according to official information obtained by MARINE ENGINEERING AND SHIPPING AGE. J. R. Patrick, president, and William W. Rigley, Jr., chairman of the Board, were in conference at Chicago, Ill., early last month with other company officials and took up, among other things, the question of a new vessel. The specifications have not yet been completed, although it is understood that the steamer will have a length of about 300 feet with a 50 foot beam, to be driven by twin triple expansion engines.

The proposed new steamer will be equipped with all modern features for the two hour run from Los Angeles harbor to Catalina Island and the acquisition of this boat will give the company four ships in this service.

Ship Construction Program Reports Are Again Discussed

REPORTS were again current in marine circles during the past month that the Union Tank Ship Corporation of New York is planning to enter the oil carrying trade on the west coast with eleven new motor tank ships costing approximately $12,000,000 and pipe lines and loading stations to cost about $1,000,000. The announcement is credited to Herbert A. Blumenthal, president of the corporation, and refers to a contract with the Sun Shipbuilding Company for the construction of these ships.

Investigation by MARINE ENGINEERING AND SHIPPING AGE disclosed the fact that the Union Tank Ship Corporation has an office at 25 Broadway. From the Chester, Pa., offices of the Sun Shipbuilding Company it was learned that the yard has no contract with the corporation for the proposed vessels. The proposition, it was stated, has been talked about for some time but information as to definite action is lacking. It is understood that the new tankers were to be of the steamship *Bidwell* type. This vessel is one of three ships taken over from the government by the Sun company and converted to Diesel drive. The ship is now at sea; under charter.

Charles Ward Low Bidder for Pipe Line Dredge

Chas. Ward Engineering Works, Charleston, W. Va., with a price of $427,000, submitted the lowest price for the construction of one 15-inch hydraulic pipe line dredge at the U. S. Engineer Office, Chicago, Ill., on November 15.

Bids Asked for Matson Liner

THE Matson Navigation Company of San Francisco has asked for bids for the construction of a fast passenger and freight liner, according to reports from the West Coast. It is understood that the proposed liner will have accommodations for about 500 first class passengers and that eastern and western shipyards will submit figures on the contract.

F. D. Tenney is president of the company, W. H. Roth, manager, and A. C. Dietrix, assistant manager. The new vessel will probably be put on the San Francisco-Honolulu run.

Passenger Boats Are Planned by New MarMack Company

THE MarMack Transportation Company, Inc., with general offices at 246 Wood Street, Pittsburgh, Pa., has been organized under the laws of the State of Delaware with a capital stock consisting of 10,000 shares of common without nominal or par value and 5,000 shares of preferred stock having a par value of $100 each. Harry F. Martin is president of the Corporation and Captain James A. McDavid is secretary and treasurer.

The company was organized for the purpose of operating a line of steam vessels of the passenger, freight and excursion type, the excursion vessels to be run to and from the amusement park to be owned and operated by the company in the vicinity of Pittsburgh, Pa. The passenger and freight business is to be between Pittsburgh, Pa., and New Orleans, La. It is the idea of the company to build steamers of the side wheel type, at least one of which is to be large enough to accommodate 5,000 persons in the excursion trade and 500 persons in the passenger trade.

Coastwise Shipping Laws Will Not Be Extended to the Philippines

President Coolidge has no present intention of extending the application of the coastwise shipping laws to the Philippines, it was stated at the White House on November 23. The President has received a report from the State Department which expresses doubt as to the propriety of doing so because of the provisions of certain treaties.

Marine Congress Is to Become a Permanent Body

AT a meeting of the Central Committee of the American Marine Congress, on November 9 at the Waldorf-Astoria Hotel, New York, a sub-committee of the Marine Congress was appointed to draft a workable plan for the permanent organization of the Congress.

The sub-committee is composed of the following:

Myron W. Robinson, former president American Manufacturers' Export Association, chairman.
Winthrop L. Marvin, vice-president American Steamship Owners' Association.
C. H. Potter, president United States Ship Operators' Association.
O. E. Bradfute, president American Farm Bureau Federation.
Captain John F. Milliken, secretary of the Neptune Association.
E. E. Spafford, Commander, New York Department, American Legion.
H. A. Magoun, president Atlantic Coast Shipbuilders' Association.

The first meeting of the sub-committee was held at the offices of Colonel E. A. Simmons, former president of the American Marine Association, at 30 Church street, New York on November 21, when plans to consolidate the various shipping organizations throughout the country into the American Marine Congress, to unify and strengthen the efforts now being made to promote the cause of American shipping, were discussed.

As a preliminary step toward the combination the committee has undertaken a canvass of sentiment among existing associations. When this survey is completed another conference will be called at which, if the plan is approved, a constitution and by-laws will be formulated and further steps will be taken to create an effective organization.

The general sentiment at the committee meeting was that the work of educating the public on marine questions, and bringing about co-ordination of all branches of industry on a shipping policy for the country, would be facilitated by a strong central body. Objections to the existing system showed that the separate organizations are frequently working at cross purposes, their efforts are sometimes dissipated for this reason and a centralized association would be more effective. Among the bodies affected by this plan would be the American Marine Association, the Atlantic Coast Shipbuilders' Association, the National Merchant Marine Association and others.

Bids for Steel Towboat Open Dec. 19

The First and Second Mississippi River Districts, 1006 McCall Building, Memphis, Tenn., will receive sealed proposals for furnishing one stern-wheel steel towboat, until 11 A. M., December 19, 1923.

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First Annual Banquet of American Marine Congress at the Waldorf-Astoria Hotel, New York, November 8

Construction of 25 Barges Planned

THE construction of 25 new steel barges, to replace wooden barges on the Warrior River, Ala., is under consideration by the U. S. Government Warrior River Barge Line, according to latest advices.

In addition to the 15 new wooden barges, under consideration, the West Kentucky Coal Company of Sturgis, Ky., plans to build 15 additional boats, or a total of 30 in all. The coal company will build all the barges at its ways at Paducah, Ky.

Steel Pontoon Bids

At the opening of tenders by the U. S. Engineer Office, Rock Island, Ill., the Dubuque Boat & Boiler Works, Dubuque, Iowa, submitted the low price for twenty steel discharge pontoons, 38 by 14 by 3 feet, and their bid was recommended for acceptance. Two companies submitted proposals as follows:

Dubuque Boat & Boiler Works, Dubuque, Iowa, $44,840.

Rock Island Bridge & Iron Works, Rock Island, Ill., $47,200.

Dravo Gets Barge Work

The Pan-American Petroleum Company, of New York, has awarded a contract for a steel tank barge to the Dravo Contracting Company, Pittsburgh, Pa. The boat will have a length of 200 feet, beam 40 feet, depth 10 feet 6 inches.

The Dravo Company also has a contract for two additional barges, each 120 feet long by 28 feet 6 inches wide and 6 feet 6 inches deep.

Terminal and Dock Project

P. S. Gilchrist, Charlotte, N. C., is reported as having in preparation plans for a phosphate terminal and new dock for the U. S. Export Chemical Corporation, Krause Building, Tampa, Fla. It is understood that the project will cost approximately $400,000.

The Atlantic Deeper Waterways Association has chosen Newark, N. J., as next year's convention city.

Reconditioning of Three Ships Awarded Federal, One to Staten Island and One to Navy Yard

THE Shipping Board has awarded contracts for reconditioning of the transports *Marne, Cantigny, Ourcq, Tours* and *Aisne* to the Federal Shipbuilding Company, of Kearny, N. J., the Staten Island Shipbuilding Company, of Staten Island, and the Brooklyn Navy Yard, Brooklyn, N. Y. The work on the *Cantigny, Marne* and *Tours* has been awarded to the Federal yard for $1,004,650, for completion within 75 and 100 and 125 days, respectively. The Staten Island yard received the work on the *Ourcq* for $389,520, to be completed in 100 days and the Brooklyn Navy Yard obtained the work on the *Aisne* for $390,000, to be completed in 90 days.

Eleven shipyards submitted bids and two navy yards offered estimates, all of which were taken to Washington by Mr. Gibbs for the final decision.

The ships are to be refitted for cargo and passenger service, the principal items in the specifications providing for the installation of approximately 45,000 feet of new refrigeration space in each vessel and the removal of such material and equipment as was necessary for the putting of the steamers in service as troop ships.

Bids Open December 1 at Mobile for Five Barges

The United States Engineer Office, at Mobile, Ala., will open bids at 11 A. M., December 1, for the construction and delivery of five steel barges. Each boat is to have a length molded of 100 feet, beam 25 feet, depth 5 feet, and to be constructed with cargo boxes, two of the barges being delivered afloat at Lock A, Cumberland River, forty miles below Nashville, Tenn., and three barges delivered at Mobile, Ala.

Southern Company Planning Fleet of River Craft

According to information obtained by MARINE ENGINEERING AND SHIPPING AGE, the American Rolling Mill Company, Ashland, Ky., plans to construct private river terminals at Zanesville, Ohio, on the Muskingum River, and at Ashland, Ky., on the Ohio.

It is said the company plans a large fleet of towboats and barges for its own use.

G. M. Chelf, formerly of the New York office of the Black Diamond Steamship Corporation, is now in charge of the Philadelphia branch of the same line.

Marine Men Witness Test of New Bethlehem Oil Engine

ABOUT one hundred naval architects, marine engineers and ship operators visited the Bethlehem Works of the Bethlehem Steel Company on November 22, on the invitation of the officials of the company, to inspect the new 2,900 brake horsepower Bethlehem two-cycle, single-acting marine oil engine. The engine, designed by Arthur West, has been run an equivalent of 50,000 sea miles without replacements of any sort and without any wear being apparent on the engine.

New Towboat Building

The Evansville Sand & Gravel Company is having a new towboat built at the Evansville Ways Company, Evansville, Ind. The boat is 112 feet long, 24 feet beam, depth 4 feet 3 inches. She is to be equipped with two boilers and also compound engines with 12-inch cylinders and 6-foot stroke.

John Steinman, superintendent of the Buffalo yard of the American Shipbuilding Company, has been appointed superintendent of the Cleveland yard of the company, to fill the vacancy caused by the resignation of the present superintendent.

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Current American Shipbuilding

On October 1, 1923, American shipyards were building or under contract to build for private shipowners 226 steel vessels of 160,351 gross tons, compared with 152 steel vessels of 140,929 gross tons on September 1, 1923.

There were 8 wood vessels of 1,004 gross tons building or under contract to build for private shipowners during the same period, compared with 11 wood vessels of 1,270 gross tons on September 1, 1923.

Following is a summary of reports of shipyards to the Bureau of Navigation, Department of Commerce, showing the number and gross tonnage of steel and wood vessels of 100 gross tons and over under construction or contract for private owners on October 1, 1923:

Companies	Steel		Wood	
	No.	Gross tonnage	No.	Gross tonnage
American Bridge Co., Pittsburgh, Pa.	95	45,050	..	....
American Shipbuilding Co., Cleveland, Ohio	3	22,784	..	....
Arthur D. Storey, Essex, Mass.	...	.....	1	140
B. H. Elliot (Inc.), Houston, Tex.	...	.....	1	100
Bath Iron Works, Bath, Me.	1	175	..	....
Bethlehem Shipbuilding Corporation (Ltd.):				
Baltimore Dry Docks Plant, Baltimore, Md.	1	920	..	....
Harlan Plant, Wilmington, Del.	2	792	..	....
Sparrows Point Plant, Sparrows Point, Md.	3	13,600	1	500
Union Plant, San Francisco, Calif.	2	10,000	..	....
Booz Bros., Baltimore, Md.	...	.....	1	144
Charles Ward Engineering Works, Charleston, W. Va.	4	1,030	..	....
Craig Shipbuilding Co., Long Beach, Calif.	3	760	..	....
Dravo Contracting Co., Pittsburgh, Pa.	48	15,180	..	....
Federal Shipbuilding Co., Newark, N. J.	1	800	..	....
Geo. Lawley & Son Corporation, Neponset, Mass.	2	550	..	....
Great Lakes Engineering Works, Ashtabula, Ohio.	1	1,600	..	....
Great Lakes Engineering Works, River Rouge, Mich.	1	.....	..	....
Howard Shipyards Co., Jeffersonville, Ind.	2	995	..	....
Ira S. Bushey & Sons (Inc.), Brooklyn, N. Y.	...	.....	3	....
James Rees & Sons Co., Pittsburgh, Pa.	1	175	..	....
John H. Mathis Co., Camden, N. J.	5	450	..	....
Johnson Iron Works, Dry Dock & Shipbuilding Co., New Orleans, La.	1	250	..	....
Los Angeles Shipbuilding & Dry Dock Corporation, Los Angeles, Calif.	3	710	..	....
Manitowoc Shipbuilding Corporation, Manitowoc, Wis.	2	5,600	..	....
Marietta Manufacturing Co., Point Pleasant, W. Va.	10	3,279	..	....
Nashville Bridge Co., Nashville, Tenn.	4	1,060	..	....
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.	1	1,250	..	....
New York Shipbuilding Corporation, Camden, N. J.	12	16,050	..	....
Pusey & Jones Co., Wilmington, Del.	1	350	..	....
Staten Island Shipbuilding Co., Mariners Harbor, N. Y.	5	1,200	..	....
Sturgeon Bay Dry Dock Co., Sturgeon Bay, Wis.	2	1,000	..	....
Sun Shipbuilding Co., Chester, Pa.	4	1,479	..	....
Supple & Martin Shipbuilding Co., Portland, Ore.	4	266	..	....
Toledo Shipbuilding Co., Toledo, Ohio.	2	13,000	..	....
Vineyard Shipbuilding Co., Milford, Del.	...	.....	1	120
Total	226	160,351	8	1,004

Million for P. & R. Piers and Machinery at Port Richmond

IT has been announced that the Philadelphia and Reading Railway Company proposes to spend approximately $1,000,000 for new machinery, additional piers and other ore-handling equipment at Port Richmond. This equipment is in addition to the $3,000,000 grain elevator and $1,000,000 to be spent for a McMyler coal-dumping apparatus.

Since the erection of the present ore pier at Port Richmond twelve years ago the ore plant has had a monthly average capacity of 36,067 tons. During the present year, however, this business has developed so rapidly that additional facilities are necessary.

The plans include the enlargement of Pier 14, and the installation of another set of ore-handling machinery, at an estimated cost of $915,000. It is said that when this machinery has been installed the machinery on the present pier will be overhauled and renewed as business permits. A pier also will be built south of Pier A, to relieve Pier 14. The approximate cost of this work will be $600,000. Extensive work also will be done on the boiler house, including the installation of a new 1,000-horsepower boiler.

TRADE PUBLICATIONS

UNDERFEED STOKERS.—The Westinghouse Electric and Manufacturing Company, Stoker Department, South Philadelphia Works, Philadelphia, Pa., describes in some detail the design of a new model multiple retort underfeed stoker. A prominent feature of the new design is the positive control of the contour of the fuel bed. Another feature is the agitating element mounted across the lower end of the stoker adjacent to the retorts which provides a means for maintaining a minimum loss due to combustible in the refuse. The main structure of the stoker is built with heavy supporting members to assure perfect alinement of the parts as well as easy access to an individual part or any group of parts.

WESTINGHOUSE MARINE LOG.—The *Westinghouse Marine Log*, which was initiated as an internal house organ by G. W. Froebel, recently appointed manager of the Westinghouse Marine Department, has made its first appearance for general circulation in marine circles, being distributed to naval and marine officials, shipowners, ship operators, naval architects and port engineers. This issue, which was first distributed at the Marine Exposition, contains a leading article on the "Diesel Electric Drive" by W. E. Thau. Other articles were written by W. B. Flanders, H. C. Coleman, C. Schmidt, C. C. MacMillan, H. M. Southgate and William H. Easton. Articles are also included, written outside of the Westinghouse organization entirely, by Captain Richard H. Leigh, U. S. N., former commander of the U. S. S. *Tennessee*, and George Pierce of William Cramp and Sons Ship and Engine Building Company.

AIR HOISTS.—Air hoists, patented and built by the Hanna Engineering Works, Chicago, Ill., are described and illustrated with special emphasis given to special features in catalog No. 14 now being sent out by the company. These hoists are designed to meet every known requirement of industry. They embody the simplest possible mechanism and it is stated are free of unnecessary fittings and features that would add to the difficulty of maintenance. The catalog also contains in tabulated form the capacities, weights, code words and other information on Hanna air hoists.

CHARCOAL IRON BOILER TUBES.—An interesting book prepared by the Parkesburg Iron Company, Parkesburg, Pa., outlining the development of process of manufacturing charcoal iron boiler tubes is now available on request. By means of illustrations and descriptive matter the entire story of tubes from the raw material to the finished product is explained.

LIGHTING DATA.—Four bulletins on the use of proper lighting facilities in industry have been compiled by the Department of Publicity, Edison Lamp Works, Harrison, N. J. Two of these on lighting legislation and the lighting of steel mills and foundries will be of special interest to our readers.

FLEXIBLE COUPLINGS.—The new flexible coupling is described in a pamphlet issued by the De Laval Steam Turbine Company, Trenton, N. J. This coupling, which has been developed for turbines or other motors geared or direct coupled to pumps, generators, and similar machinery, consists of two opposed flanges mounted on the driving shafts respectively. One flange carries bolts or pins which enter holes bored in the opposing flange, but not coming into metallic contact with the latter, as the driving force is transmitted through steel-lined molded rubber bushings slipped over the pins. All parts are made to limit gages and all similar parts are interchangeable.

INCREASING MARINE PROFITS.—The Diamond Power Specialty Company, Detroit, Mich., is distributing a new marine bulletin, No. 143, which shows different types of Diamond soot blowers applicable to marine boilers of various designs. Complete details of the blowers with photographs of specific installations and their performances are included in the book.

BETHLEHEM OIL ENGINES.—Based on many years' experience in the design of gas engines, the new two-stroke cycle Diesel engine, built by the Bethlehem Steel Company, Bethlehem, Pa., offers an engine which is American throughout and has numerous features which adapt it particularly well to marine service. A description of the engine, with numerous photographs and drawings showing its construction and special features, is given in catalogue "N," which was distributed at the Marine Exposition and is now available on request to the company. In brief, the engine is of the vertical two-stroke cycle single-acting type constructed in units of 4, 6 or 8 cylinders, running at speeds of from 116 revolutions per minute for land power purposes down to 90 revolutions per minute for marine power installations.

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Foreign Shipping and Shipbuilding Activities

Two Battleships of Argentine Navy to Be Reconditioned

AMERICAN and foreign shipyards are reported as preparing proposals for the reconditioning of two battleships of the Argentine navy, the *Moreno* and the *Rivadavia*. These ships are understood to be on their way to the United States and a representative of the Argentine Government has already reached New York presumably to take up details regarding the proposed work.

According to the best information obtainable, the ships will be converted to oil burners and undergo a general overhauling, the contracts involving an expenditure of a large sum of money.

Floating Dry Dock Being Designed for Mexico

THE Des Moines Steel Company, Curry Building, Pittsburgh, Pa., is reported as designing a 6,000-ton floating drydock for the Government of Mexico, to be used at Vera Cruz. The dock is to have a length of about 320 feet; width, 100 feet, and light draft, 3 feet 6 inches. It is proposed to build the dock at the company's Pittsburgh Works, floating it down the Ohio and Mississippi Rivers to the Gulf of Mexico, and then to Vera Cruz.

Canadian Pacific Will Add Two Ships to Fleet

E. W. Beatty, K. C., president of the Canadian Pacific Railway, recently addressed a meeting of the Vancouver board of trade and announced that his company proposes to add two large modern steamers to its coast fleet, immediately, to take care of increasing tourist traffic. He also announced the early completion of a new pier at the harbor to cost several millions of dollars.

Government of Queensland in Market for Dredge

Bids are being invited by the Government of Queensland, Australia, on a twin-screw stern-wheel bucket hopper dredger, according to United States Consul Romeyn Wormuth, at Newcastle. The dredger is to have a draft not to exceed 13 feet when fully loaded. The specifications call for a hopper capacity of 16,000 cubic feet and dredging depth of 40 feet below water level and a continuous speed, when fully laden and with bunkers full, of 9 knots per hour. A statement of the earliest date at which the dredger can be delivered complete at the Port of Brisbane should accompany the bid.

The single copy of the specifications received by the Industrial Machinery Division of the Department of Commerce has been placed in the New York office of the Bureau of Foreign and Domestic Commerce, where it may be consulted by interested manufacturers.

Consul Wormuth states that he has been informed that twelve copies of the contract and specifications have been forwarded to the State Engineer, Albany, N. Y., and that another set is available at the office of the trade commissioner for Australia, 44 Whitehall Street, New York, N. Y.

World's Largest Dry Dock Opened By Governor General of Canada

THE mammoth graving dock built for the St. John Dry Dock and Shipbuilding Company, Ltd., St. John, N. B., was formally opened on Monday, October 26, when the steamer *Kongshaven* entered the dock for repairs to her rudder post, which had been carried away a few days previously. The event was witnessed by guests from all over Canada, the United States and England, including among others Lord Byng, the Governor General, of Canada; Grant Hall, vice-president of the Canadian Pacific Railway; Sir Henry Thornton, president of the Canadian National Railways, Sir Joseph Isherwood of London and New York; James French, principal surveyor for Lloyd's in Canada and United States; James B. Craven of Larchmont and New York; and A. MacCorkindale of the Morse Dry Dock and Repair Company, Brooklyn, N. Y. F. M. Ross, manager of the St. John Dry Dock and Shipbuilding Company, was on hand to greet all the guests and supervise in general all details.

The dimensions of the graving dock are as follows: Extreme length, 1,225 feet; length on keel blocks, 1,150 feet (the dock can be subdivided by an additional caisson, thus making two docks, one 650 feet long and one 500 feet long); width of dock entrance, top, 133 feet; bottom, 125 feet; draft above sill at ordinary spring tides, 42 feet; bottom of dock below sill, 4 feet 6 inches.

The St. John Dry Dock and Shipbuilding Company also has an 1,800-ton marine railway and the industrial buildings comprise a machine shop, plate shop, boiler shop, pattern shop and joiner shop, all of steel and concrete construction, which will soon be fully equipped with adequate machinery for handling the largest job that can be brought into the dry dock.

French Steamship Company Places Order for Twin Screw Motor Passenger Liner

By Our Paris Correspondent

CONSIDERABLE interest has been aroused in France in connection with the order which has just been placed by the big French steamship company, "Services Contractuels des Messageries Maritimes," for a passenger vessel which is to be propelled by two internal combustion engines developing a total power of about 4,500 horsepower. The extreme scarcity of motorships so far under construction in France, which I pointed out in the May issue, is responsible for the stir aroused by this recent development.

So far only one motorship is under construction in French shipyards, the *Camrahn*, a cargo vessel of 11,700 tons deadweight built by the Chantiers de la Loire to the account of the Chargeurs Reunis. The hull of that vessel is still unfinished at Nantes, while the engines have been delivered months ago.

The order for the motorship of the Messageries Maritimes has been placed with the Chantiers de France at Dunkirk. The vessel will be built to the same design as the *Sphinx*, a type of vessel which is run by the company on the Mediterranean lines. But it is noteworthy that the hull only will be built by the Chantiers de France, while the engines will be supplied by either Burmeister & Wain or the Sulzer Bros.

According to recent reports, it is likely that the order will be placed with the latter concern and that the engines will be built at the Saint-Denis (near Paris) works of the French branch of Sulzer Bros. It will be recalled that the engines of the *Camrahn* have been supplied by the same concern which had these engines built at its Winterthur works (Switzerland).

Now that two big French steamship companies have decided on a first experiment of internal combustion engines, there is some speculation as to whether other firms will follow these examples in the near future.

French Line to Resume Canadian Service

It is learned that the French Line has just decided to resume its regular service with Canada, which was suspended at the beginning of the war. The home port, however, is to be Bordeaux instead of Havre as before the war. Two passenger vessels will be placed on this run: the *Roussillon* (ex-German *Goeben*), 8,819 tons gross, and *La Bourdonnais* (ex-German *Scharhorst*), 8,287 tons gross. Calls will be made at Halifax on the outward route of the two vessels which will sail from Bordeaux every 21 days. On the homeward voyages they will call at Vigo before reaching Bordeaux. The first call at Halifax will be made on December 2.

It is noteworthy that so far no French company is running regular passenger and cargo services to Canada; this service is being maintained from Havre by two American companies.

Another interesting development in connection with French shipping is the recent organization of regular services between French ports and Petersburg by the Messageries Maritimes. This is the first resumption of services with Russia.

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Marine Construction News of the Month

Ship Contracts — New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIPBUILDING AND REPAIRS

Tanker Drydocked, Galveston, Tex.—The tanker E. B. Kemp has been drydocked for repairs at Galveston.

Steamship Overhauling, Portland, Ore.—The steamer West Jena, of the Shipping Board, has been drydocked at Portland for overhauling.

Miscellaneous Repairs, Philadelphia, Pa.—The Cramp Shipbuilding yard was awarded miscellaneous repairs to the Norwegian motor tanker Hamlet.

Repairs to Steamer, Charleston, S. C.—Steamship Janelew has been placed on the ways of the Charleston Dry Dock and Machine Company for repairs.

Damage Repairs, San Francisco, Cal.—The steamer Elizabeth, which recently went ashore at Bandon, Ore., has been taken to San Francisco for drydocking for repairs.

Oil Carrying Barge Launched, Chester, Pa.—The Sun Shipbuilding and Drydock Company has launched a 140-foot, 5,000 barrel oil carrying barge for the New York Central Railroad.

British Tanker Reconditioning, San Pedro, Cal.—The giant British tanker Albertolite has been drydocked at San Pedro to undergo reconditioning preparatory to a cruise to Chile.

British Steamer Repairs, Chester, Pa.—The British steamship Nowshera has been taken to the Sun Shipbuilding and Drydock Company's yards for drydocking and miscellaneous repairs.

Fire Damage, West Coast.—The freighter Diana Dollar, which caught fire off the Mexican coast recently, has suffered damages estimated at $500,000, according to messages from her master.

Steamer Segvia Repairs, Charleston, S. C.—After having grounded recently while on her way to Europe from Galveston, the steamship Segvia was taken to the Charleston Drydock & Machine Company to undergo repairs.

West Arrow Drydocked, Boston, Mass.—The American steamship West Arrow, recently in collision with the White Star liner Haverford, has been taken to Boston for drydocking for survey. Her forepeak tank was crushed in and five plates broken.

Steamer Drydocked, Newport News, Va.—The Danish steamer Norden, damaged recently by grounding off the Canadian coast, has been taken to the docks of the Newport News Shipbuilding and Dry Dock Company for surveying and repairing.

Ship Repair Revival, Philadelphia, Pa.—A revival in the repair branch of the shipbuilding industry in the Delaware River district has been reported by J. Harry Mull, president of the William Cramp & Sons Ship & Engine Building Company at Philadelphia.

Steamers Drydocked, San Francisco, Cal.—The Government freighter West Montop has been placed on the Bethlehem drydock to have a new tail shaft and other work performed and the tanker China Arrow went on drydock at the same yard for general repairs.

Bids to Be Asked, Boston, Mass.—The steamer City of Rockland, which went ashore on Dix Island while bound from Bath for Boston, has been floated. The Eastern Steamship Lines, Inc., owners, will ask for bids to recondition the vessel, which is said to be badly damaged.

Steamship Drydocked for Repairs, Charleston, S. C.—The Springfield has been withdrawn from the service of the Carolina Company of Charleston and has been drydocked for repairs. It is stated that after repairs are completed the vessel may be reallocated by the Shipping Board.

Raised Vessel to Undergo Repairs, Charleston, W. Va. — The steamship Springfield, recently rammed and sunk by a Clyde Line steamer in St. John's river in Jacksonville, Fla., has been raised and taken to the yard of the Charleston Dry Dock and Machine Company for repairs.

Dredge, Portland, Ore.—The Port of Portland, Spalding Building, is having plans prepared for dredge to be equipped with four 750 horsepower Diesel engines and 30-inch suction and discharge pipe. J. H. Polhemus, general manager; G. B. Hegardt, Stark Street Dock, engineer.

Rudder Test, Bridgeport, Conn.—It has been announced that the Kitchen patent rudder has undergone a successful test aboard the yacht Wanda II off Bridgeport, Conn. The yacht, which is electrically controlled, is said to have stopped during the tests in one and one-half times her length in eighteen seconds from full-speed-ahead motion.

Leviathan to be Drydocked, Boston, Mass.—The Leviathan will be laid up for three months this winter, upon the completion of her next voyage, after her arrival in New York on November 26. She will go to the Commonwealth drydock in Boston after leaving the Shipping Board piers at Hoboken and will return to service in the early spring.

President Wilson Bids, West Coast.—At the opening of tenders for carrying out repairs on the Pacific Mail liner President Wilson the following companies submitted bids: United Engineering, $1,712; General Engineering, $2,282; Moore Drydock Company, $2,293, and Smith & Scanlon, $3,890. The specifications covered work on her engines.

Ships to Burn Oil.—The Japanese steamship line, Toyo Kisen Kaisha, has decided to convert the Tenyo Maru and the Shinyo Maru, operated on the Transpacific service, into Diesel engine motorships and has ordered the engines from Germany, according to recent London reports, the company having appropriated for their conversion 1,000,000 yen.

Vessel Launched, Newport News, Va.—The City of Birmingham, building at Newport News for the Ocean Steamship Company, has been launched. Her general dimensions are: length over all, 400 feet; beam, 52 feet; depth molded to hurricane deck, 35 feet; draft fully loaded, 18 feet 6 inches. She has a gross tonnage of 6,500 tons, an indicated horsepower of 2,900, and a speed of 12½ knots.

Installation of Radio Finders, West Coast.—Kolster radio direction finders are to be installed on five of the Matson Navigation Company's six-passenger steamers and two of its largest freighters. The H. F. Alexander, of the Admiral Line, was the first Pacific Coast vessel to have a radio direction finder installed. The Admiral Line officials have ordered six more finders to be installed on their coastwise vessels.

Salvage, Pacific Coast.—It has been learned that Merritt, Chapman and Scott have been commissioned by the United States Navy to salvage all available gear, etc., from the seven destroyers which recently went on the rocks during a fog on the California Coast. There is very little or no hope of saving any of the vessels. When the salvage operations are complete, it is expected that the wrecks will be blown up.

Shipyard Work, Chester, Pa.—The Sun Shipbuilding and Drydock Company, Chester, was awarded the work of drydocking the steamship West Inskip and also the Herbert L. Pratt for general repairs. The same company was the successful bidder against the Newport News Shipbuilding Company for the contract to repair the British steamship Nile, which requires drydocking to paint and scrape bottom, with a possibility of renewing her propeller and also the tailshaft.

Shipyard Activities, West Coast.—The General Engineering and Drydock Company submitted the lowest figures on the following work. Government steamer Angel: General Engineering, $1,212; Hanlon Drydock Company, $1,511; Bethlehem Shipbuilding, $1,653, and the Moore Drydock Company, $1,704. Prices for work on the Hoven were: General Engineering and Drydock Company, $1,888; United Engineering Company, $1,938; Moore, $2,162, and Bethlehem, $2,358.

Ship Contracts, New Orleans, La.—The Johnson Iron Works, New Orleans, has been awarded the following work: Tampa Inter-Ocean Steamship Company's steamer Narbo, general repairs, consisting of drydocking, painting, pulling tail shaft and overhauling of auxiliaries; installation of new furnaces in all boilers on steamship Moranzania, of Vacaro Brothers, and general repairs to the West Ira, of Lykes Brothers, consisting of drydocking, painting, and pulling tailshaft.

Diesel Yacht Launched.—According to announcement by Cox & Stevens, designers of the ocean-going Diesel yacht Vanadis, the vessel was successfully launched on November 15 and will be delivered to her owner, C. K. G. Billings, early in 1924. The Vanadis has a length of 240 feet, beam 35 feet, draft 14 feet, and has two Diesel engines developing 1,800 horsepower, which produces a speed of fourteen knots with a cruising radius of 12,000 miles. She is said to be the largest Diesel yacht yet constructed.

Diesel Dredges Launched, Chester, Pa.—The A. McKenzie and the W. L. Marshall were launched on November 19 at the Chester plant of the Sun Shipbuilding Company. These Diesel electric dredges were built by the Sun yard for the engineering corps of the War Department. They will be delivered in January and February. The Dan C. Kingman and the William T. Russell will be launched in March and April. The dredges are 245 feet long, 46 feet beam and 19 feet 6 inches loaded draft, and are of 2,000 deadweight tons each.

Ship Work, Mobile, Ala.—The Alabama Dry Dock & Shipbuilding Company, Mobile, Ala., has been awarded the following work: Steamship Hancock County, renewing of heater tubes and tube sheet and heater installation; Coast Guard cutter Tallapoosa, repairs to collision damage; steamship Shenandoah, engine repairs; steamer Scott, of Mississippi-Warrior Service, boring and fitting two propeller wheels to shaft; steamship Lysefjord, extensive reconditioning; tug Jim Sid, boiler repairs; and a joiner job on the steamer Bay Queen.

Warships Overhauling, Brooklyn, N. Y.—For a general overhauling the battleships Arkansas and Wyoming and the destroyers Goff, Gilmer, J. Paulding, Fox, Barry, Williams, Hatfield, Overton and King have arrived at the Brooklyn Navy Yard. The same yard has obtained several other jobs, including reconditioning of the Shipping Board freighter Aisne and the cutting up of the partly completed battleships South Dakota and Indiana. This work will prevent the lay-off of workman planned for January 1 and will result in hiring additional men, according to the yard.

Dispatch Boat Conversions, South America.—The Bethlehem Shipbuilding Corporation has been awarded the contract for considerable work on two ships of the Aviso class (dispatch boats) for the Argentine navy. Each vessel is equipped with three Thornycroft boilers, the contract calling for the installation of the Bethlehem-Dahl fuel oil burning system with pumps, heaters, strainers, etc. The contract also requires that the boilers be capable of burning any kind of oil on the market and each fireroom is to be fitted as a separate unit. The work will be done at the Argentine navy dock yards.

Repair Contracts, Buffalo, N. Y.—The Buffalo Dry Dock Company is engaged in installing a new wheel and new tail shaft on the steamer Juniata, passenger steamer of the Great Lakes Transit Corporation, and also installing a new wheel on the tug A. C. Dutton, of the Rochester Terminals and Canal Corporation. The Riley Dry Dock Company,

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Buffalo, is engaged in the following work: Docking the lake barge Richland Star, of the Benjamin Iron Company, and the tug Saginaw, for minor hull repairs. The same company has completed extensive repairs on the steam barge Mohegan, of the Inland Marine Corporation.

Ship Work, Great Lakes.—The following ship work has been awarded on the Great Lakes: Steamer Malietoa, drydocked at Cleveland for repairs to leak caused by grounding; steamer Conneaut, docked at Ashtabula for repairs to stern tube; steamer Glenisla, drydocked at Collingwood for repairs to collision and grounding damage, and the Berryton, repairing at Port Arthur as a result of collision, at which time the steamer's stern was shoved in several inches, her hawse pipe broken and eighteen plates damaged. The Bennington, which collided with the Berryton, is having temporary repairs at Ecorse. She also has eighteen damaged plates.

Transports to Be Rebuilt, South Atlantic Yards. Two United States Army transports Marne and Onreq, which were turned over to the Shipping Board several months ago to be laid up with the steel fleet in the James River, near Camp Eustis, have been taken to Newport News and Norfolk to be made ready for service. These transports, built during the war for use of the United States Army Transport Service, but not completed in time to transport troops, are 448 feet long with a 58-foot beam and have ample accommodations for passengers and freight. Certain alterations would be necessary to make them suitable for the combination freight and passenger service between New York and London, but officials are of the opinion that that could be done easily, quickly and economically.

Ship Work, San Francisco, Cal.—The General Engineering and Drydock Company has received the following contracts: Associated Oil Company's tanker Kewanee, general repairs, preparatory to undergoing annual inspection; Standard Oil tanker J. A. Moffett, repairs; dredge Big V., extensive alterations, having been idle some time; yacht Shawnee, cleaning, painting and repairs to propeller; steamer Point Arena, reconditioning and drawing tail shaft; Shipping Board steamer Pallas, new line shafting and new spring bearings and general repairs; ferryboat Golden West, drydocking, cleaning and painting and drawing tail shaft; Mexican steamer Bolivar, changing from coal to oil-burning equipment and drawing tail shaft, and the fishing tugs Henrietta and Islander, undergoing miscellaneous repairs and cleaning and painting.

Shipyard Work, West Coast.—The Bethlehem Shipbuilding Corporation, San Francisco, Cal., is engaged in the following work: cleaning, painting and repairing the propeller of the John Line's Swedish motorship San Francisco; cleaning, painting and drawing of the tailshaft on the Shipping Board steamer West Conob; refitting of the starboard propeller on the British motorship Hauraki, of the Hind, Rolph & Company; rudder and propeller repairs to the McCormick Steamship Company's steam schooner Celilo; fitting of propellers on the new steam schooner Esther Johnson, of the A. B. Johnson Company, preparatory to undergoing trial trip; hull repairs on the Union Oil Company's tanker La Placentia; miscellaneous repairs to the Mexican, of the American-Hawaiian Line. At present the Bethlehem yards are engaged in reconditioning the American-Hawaiian freighter Dakotan, following her mishap on the Lower California coast some time ago, this work representing an expenditure of approximately $100,000.

SHIPYARDS AND DRY DOCKS

New Dock Placed in Service, Brooklyn, N. Y.—On November 20 the new 10,000-ton floating dock at the Robins plant of the Todd Shipyards Corporation was placed in service, the tanker Gulfoil of the Gulf Refining Company being the first vessel to be docked. The Robins yard now has a total of two graving docks and four floating docks, bringing the total dock equipment of the Todd Corporation up to twenty-two floating docks and two graving docks.

Company Resumes Activity, Fairfield, Md.—The Union Shipbuilding Company has reorganized its repair department plant at Fairfield, Md., according to word from Baltimore. A new manganese steel hauling chain has been installed on the marine railway drydock, which will raise vessels 415 feet long and of 5,000 tons displacement. The railway is constructed so that vessels are lifted vertically out of the water on practically an even keel while being hauled on the railway. This is said to eliminate any tendency to strain the ship's structure.

Repair Plant, Wilmington, N. C.—One of the biggest fish oil manufacturing concerns operating along the Atlantic Coast, the Fisheries Products Company, has purchased from a Baltimore concern an extensive portion of the old Carolina shipyard and will operate at the water front site a shipbuilding and repair plant, including extensive machine shops, ship ways, a marine railway and other such equipment necessary for the operation of a first-class shipyard and repair plant. P. H. Hayes, president of the company, stated that his company had purchased it at auction at a cost of $19,100 all of the unsold portion of the old shipyard and that plans are now under way for the conversion of this property into a shipyard and repair plant, not alone for the building of additional vessels for their fishing fleet and the maintenance of the 24 fishing vessels they now operate, but also for commercial ship work.

PORT IMPROVEMENTS

Retaining Walls, etc., Ohio.—State Highway Department, Columbus, will build new retaining walls at Buckeye Lake in Fairfield and Licking Counties. $40,000. P. R. Murray, director.

Dredging, etc., Akron, Ohio.—City plans beautifying shores of Summitt Lake, by dredging and draining the shore lands and building lagoon system in wider points, etc. $250,000.

Breakwater, Long Beach, Cal.—Plans are being made by the city for a 3,000-foot breakwater in the vicinity of Pine Avenue Pier, 350,000 tons of rock. C. H. Windham, city manager.

Crane, Newark, N. J.—Riverside Steel Casting Company, Plank Road and Passaic River, is in the market for one 10-ton, 40-foot span electric traveling crane.

Channel Excavation, Toronto, Ont.—Sealed proposals were received on October 15, by A. Beck, chairman, Hydro Electric Power Commission, 190 University Avenue, for excavation of tailrace channel, 20,000 cubic yards of rock.

Repairs Completed, Seattle, Wash.—Repairs to Pier B, Smith's Cove public terminal, the largest ocean dock in the world, have been completed. This pier, more than half a mile long and a city block wide, was damaged by fire.

Contract Awarded, Pittsburg, Kan.—C. Hotz & Son awarded the contract for the first unit grain elevator, 170,000 bushels (capacity to be doubled at later date), to Southwest Engineering Company, Woodruff Building, Springfield, Mo. $35,000.

Breakwater, Corpus Christi, Tex.—City and Nueces County Navigation, District 1, postponed opening bids and will revise plans and re-advertise for constructing breakwater, protecting levee around turning basin and also dredging in turning basin.

Grain Elevator, Oswego, N. Y.—The Board of Public Works, Albany, awarded the contract for constructing and equipping a grain elevator, five-story, 60 by 213 feet, reinforced-concrete and steel, here, to James Stewart Company, Inc., 30 Church Street, New York. $1,119,959.

Dock Terminal, etc., Tampa, Fla.—The U. S. Export Chemical Corporation, Krause Building, is having plans prepared for dock terminal elevators and plant for manufacture of double super-phosphate. $400,000. Address, P. S. Gilchrist, Charlotte, N. C., engineer and architect.

Levees, Clarksdale, Miss.—Sealed proposals were received on October 9 by the Board of Levee Commissioners for Yazoo-Mississippi Delta, for enlarging five-mile old Ward Lake levee, 75,000 cubic yard banquette enlargement, and 10,000 cubic yards of topping. W. L. Head, chief engineer.

Dredging Ship Channel, Tampa, Fla.—U. S. Chemical Export Corporation, Krause Building, is making plans and estimates for dredging ship channel from mouth of Alafia River to main ship channel, 1,000,000 cubic yards excavation. $400,000. P. S. Gilchrist, Charlotte, N. C., engineer.

Creosoted Piling, etc., Mayersville, Miss.—First and Second Road District, Mayersville, awarded the contract for 2,650 lineal feet of creosoted piling, 6,120 feet of creosoted lumber and 50,000 feet of untreated lumber delivered at Flanton Station, to Creosote Materials Company, Q and C Building, New Orleans, La.

Contract Awarded, Lake Charles, La.—Police Jery, Calcasieu Parish, awarded the contract for navigation channel from Lake Charles to Sabine River, 125 feet wide, 30 feet deep, Section 1, 2,780,000 cubic yards, to United Dredge Company, Galveston, Tex., $383,640; Section 2, 3,270,000 cubic yards, to Smith Brothers, Alexandria, $457,800.

Lumber and Piles, New York, N. Y.—E. W. Buckley, commissioner, Department of Purchase, Municipal Building, awarded the contracts for lumber and piles to Department of Docks, to Robinson Lumber Company, New York, $113,622; Cooney, Eckstein & Company, 302 Broadway, $9,837; J. A. Maloney & Company, 1170 Broadway, $4,464.

Beaumont, Tex., Wharf Contract.—The Houston Construction Company, 3102 McKinney Avenue, Houston, Texas, has received the contract to build wharves and to dredge at Beaumont. The project includes the following: Dredging, filling, 75,000 yards; concrete wharf platform, and concrete and timber bulkhead; the total cost of the job being $267,410.

Waterway Opened, Lake Okeechobee, Fla.—Lake Okeechobee, the second largest body of fresh water in the United States, has been linked with the Atlantic Ocean, sixty-five miles away. The inlet, which extends from the lake to the ocean, was formally opened with fitting exercises and will be navigable to yachts and freighters drawing not more than ten feet of water.

Marine Cables, St. Louis, Mo.—Union Electric Light and Power Company, 12th and Locust Streets, awarded the contract for laying 12 marine cables on Mississippi River bed carrying 12,000 kilowatts of power, connecting Cahokia, Ill., power plant with St. Louis, Mo., station, to Fruin-Colnon Construction Company, Merchants Laclede Building. Engineer's estimate, $156,000.

Fire Protection System, New Orleans, La.—Sealed proposals were received by the Board of Commissioners of the Port of New Orleans, Suite 200, New Orleans Court Building, on October 11, for a fire protection system at the Sacking Plant of the Public Grain Elevator, comprising extension of existing mains and installation of hydrants and automatic sprinklers. Requisition E. D. 14014. J. H. Walsh, general manager.

Fill, etc., Portland, Ore.—The Port of Portland plans filling Guild Lake, and 1,200 acres adjoining; straightening and deepening Willamette River and Harbor, involving 3,032,760 cubic yards of dredging, $170,000. Plans are being made for dredge equipped with four 750 horsepower Diesel engines and 30-inch suction and discharge pipe. J. H. Polhemus, Spalding Building, general manager. G. B. Hegardt, Stark Street Dock, engineer.

Buffalo Harbor Improvements.—Major P. S. Reinike, United States District Engineer, Buffalo, N. Y., unfavorably reported to Washington on several recommendations made by the Buffalo City Council, the Buffalo Chamber of Commerce, and the City Planning Commission. Major Reinike's statement says that the middle gap in the breakwater of Buffalo harbor should not be closed as recommended, because the closing would create an unfavorable current through the harbor. He opposes the dredging of the Erie Basin on the ground that it is state property, part of the Barge Canal System, and could not be dredged by the federal government. Major Reinike held that the recommendation of the Lake Carriers' Association that another breakwater be constructed one mile outside the present one, or that twelve feet be added to the height of the present one would create an expense in construction that would not be commensurate with the benefits to be derived. Favorable action is expected on the recommended removal of a triangular point of rock from the entrance of the Black Rock canal and for the widening of the ship canal south of the International Bridge and the removal of shoal opposite Rattlesnake Island in the Niagara River.

GOVERNMENT WORK

Dredging, Bridgeport, Conn.—Sealed proposals were received on October 17 at the office of the U. S. Engineer, Providence, R. I., for dredging in Bridgeport Harbor.

Repairs to Seawall, Hingham, Mass.—Specification 4902—The Bureau of Yards & Docks, Navy Department, Washington, D. C., plans repairs to seawall of slip at Hingham.

Mooring Masts, Washington, D. C.—Specification

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4916—The Bureau of Yards & Docks, Navy Department, plans mooring masts at Guantanamo, Cuba; Fort Worth, Tex., and San Diego, Cal.

Bids Rejected for Piers and Wharf, Pearl Harbor, H. T.—Bureau of Yards and Docks, Navy Department, Washington, D. C., rejected bids for reinforced concrete piers and wharf at Submarine Base, here.

Catamarans, etc., Chicago, Ill.—Sealed proposals were received on November 1, at the office of the U. S. Engineer, 537 South Dearborn Street, for catamarans and pipe for 15-inch hydraulic pipe line dredge.

Repairing Jetty, Freeport, Tex.—Sealed proposals were received by the U. S. Engineer Office, Galveston, Tex., on October 31 for repairing Southwest Jetty at Freeport Harbor, Tex. Further information on application.

Steel, etc., Addison, Ky.—U. S. Engineer, P. O. Box 72, Louisville, plans purchasing one carload of 1-inch round soft steel, shop lengths, and 3,200 pounds of c.i. washers, 4 inches in diameter, for Dam 45, Addison, Ky.

Contract Awarded, Norwalk, Conn.—U. S. Engineer Office, Providence, R. I., awarded the contract for dredging 500,000 cubic yards in Norwalk Harbor to J. S. Packard Dredging Company, Turks Head Building, Providence, R. I. $89,321.

Superstructure, Ludington, Mich.—U. S. Engineer, Milwaukee, awarded the contract for removing timber superstructure and construction of concrete superstructure, Ludington, to S. M. Siesel Company, 160 Ogden Avenue, Milwaukee, Wis. $149,690.

Dredging, etc., New York, N. Y.—The contract for dredging and rock removal Area 2, New York and New Jersey Channels, has been awarded by the U. S. Engineer Office, 616 Army Building, New York, to E. Breyman, 17 Battery Place. $577,343.

SHIPPING DEVELOPMENTS

Pacific Mail Steamship Company.—The Pacific Mail Steamship Company has announced a cut in minimum first class rates between New York and Los Angeles, the fare being reduced from $270 to $250. The Pacific Mail operates in the intercoastal service.

Mississippi-Warrior Federal Barge Line.—While the Mississippi-Warrior Federal Barge Line earned a net income of $13,632.27 in the final six months of the fiscal year ended June 30, 1923, it was not sufficient to absorb the losses of the first half of the year and the report sent to Washington shows a loss for the year of $624,796.62, as compared with a net profit of $121,017 for 1921-22.

General Steamship Corporation.—Four Diesel-driven vessels, built since the World War and reputed admirably adapted for the demands of the west coast trade, are to be operated by the General Steamship Corporation between Portland and other Pacific Coast ports and those on the western shores of South America, beginning in December, upon the retirement of the Shipping Board fleet at present on the route and which is managed by the same corporation.

Davis Transportation Lines, Inc.—Control of the Charles W. Davis Transportation Company, owning and operating two steamers between New York, New Rochelle, Mamaroneck and other interior points, has been acquired by Matthew C. Brush and George R. Whitelam, heading a group of New York shipping men. The name of the company has been changed to the Davis Transportation Lines, Inc., and plans for increasing the facilities and extension of the service are under way.

New Line to the Orient.—A new steamship line to the Orient, with headquarters at Los Angeles, is being formed by a group of prominent capitalists, according to Lawrence L. Larrabee, Los Angeles attorney, who is acting as general counsel for the company. Articles of incorporation are pending and negotiations are in progress with the Shipping Board for the purchase of three steamers to be placed in the service. Two of these steamers will be 10,000 tons deadweight and will be used for freight only, while the third steamer will be 21,000 tons deadweight and will be used as a combination passenger and freight carrier.

Garland Steamship Corporation.—The Garland Steamship Corporation has announced its withdrawal from the intercoastal trade and the establishment of a trans-Pacific service in January. On the West Coast, San Francisco and Portland will be regular ports of call and stops will be made in Shanghai, Hongkong and Manila in the Far East. William M. Campion, vice-president of the line, said the new service will start with the William Campion, sailing from Portland early in January, to be followed at fortnightly intervals by the six other ships of the company. The company expects to maintain a regular schedule, with sailings every two weeks from San Francisco and Portland. The executive office will remain in New York, but the principal operating office will be in San Francisco.

American-Hawaiian Steamship Company.—The American-Hawaiian Steamship Company, which operates an intercoastal service between U. S. Atlantic and U. S. Pacific Coast ports, has announced that in addition to ferry car service which has been in operation to New York for some time past in connection with the West Shore, New York, Ontario & Western, Delaware, Lackawanna & Western, and New York, New Haven & Hartford, arrangements have now been completed for ferry car service with the Erie Railroad and New York Central Railroad. When shipments consigned care of American-Hawaiian Steamship Company, Pier 6, Bush Terminal, South Brooklyn, N. Y., move in ferry cars, the only charge incurred is 5 cents per 100 pounds to cover cost of car unloading.

International Mercantile Marine.—An important announcement has just been made by the International Mercantile Marine Company in connection with the service of the Leyland Line between Boston, Liverpool and Manchester. Beginning this month a definite ten days' schedule of sailings will be inaugurated, and in order to maintain this increased service six modern steamers of large carrying capacity have been assigned to the route. These are the steamships Nubian, Davisian, Darian, Caledonian, Daytonian and Colonian. Each steamer has a carrying capacity for about 10,000 tons of cargo, and most of them are equipped with refrigerating machinery for transporting merchandise of a perishable nature. The new schedule will be inaugurated by the sailing of the Nubian from the port of Boston on December 12 to Manchester and Liverpool, and thereafter there will be sailings at intervals of about ten days.

Canadian Government Merchant Marine, Ltd.—According to an announcement by the Canadian Government Merchant Marine, Ltd., a new monthly direct service between Vancouver, B. C., and Avonmouth, England, via the Panama Canal, was inaugurated by the sailing of the Canadian Winner on October 20. The steamers will carry eastbound grain, canned goods, general cargo and lumber, and westbound iron and steel goods, liquors and general cargo. In inaugurating this new service, it is stated, the company is carrying out its policy of opening up and taking care of new trade routes. The service is also intended to be a factor in the development of the port of Vancouver, utilizing the grain elevator accommodation and other facilities provided at that port. Following the Canadian Winner, the Canadian Prospector sailed from Vancouver on November 20. It is the intention of the Canadian Government Merchant Marine to keep four of their 8,400 deadweight steamers on the new service.

MARINE SOCIETIES

AMERICA

American Society of Naval Engineers
Navy Department, Washington, D. C.
Secretary-Treasurer—Commander S. M. Robinson, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

Society of Naval Architects and Marine Engineers
29 West 39th Street, New York
Secretary and Treasurer—Daniel H. Cox.

National Association of Engine and Boat Manufacturers
29 West 39th Street, New York City
Secretary—R. R. A. Hand.

United States Naval Institute
Naval Academy, Annapolis, Md.
Secretary and Treasurer—Commander H. K. Hewitt, U. S. N.

American Marine Association
15 Park Row, New York
President—Frank J. Shipman.

The New York Tow Boat Exchange
11 Moore St., New York.
Secretary—Irving G. Keller.

Port of New York Authority
11 Broadway, New York
Chairman—E. H. Outerbridge.
Secretary—William Leary.

Marine Engineers' Supply Men's Association
Room 507, 30 Church Street, New York.
Secretary—Robert P. Jones.

National Association of Masters, Mates and Pilots
National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

American Society of Marine Designers
Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass.

National Marine Engineers' Beneficial Association
Headquarters 311-315 Machinists Building, Washington, D. C.
Secretary-Treasurer—George A. Grubb.

Atlantic Coast Shipbuilders' Association
1600 Walnut Street, Philadelphia, Pa.
Secretary—C. S. King.

American Steamship Owners' Association
11 Broadway, New York
President—A. G. Smith.
Vice-President and General Manager—Winthrop L. Marvin.

United States Ship Operators' Association
149 Broadway, New York
President—C. H. Potter.

National Merchant Marine Association
Munsey Bldg., Washington, D. C.
President—Hon. J. E. Ransdell.

The Maritime Association of the Port of New York
78 Broad St., New York City
President—Charles H. Potter.
Secretary—Walter F. Firth.

Lake Carriers' Association
Detroit, Mich.
Secretary—George A. Marr.

Neptune Association
21 Pearl St., New York City
Secretary-Treasurer—Captain John F. Milliken.

Ocean Association of Marine Engineers
15 Whitehall St., New York City
Secretary—Bert L. Todd.

CANADA

Grand Council N. A. of M. E. of Canada
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.

GREAT BRITAIN

Institution of Naval Architects
5 Adelphi Terrace, London, W. C.

Institution of Engineers and Shipbuilders in Scotland
39 Elmbank Crescent, Glasgow.

Northeast Coast Institution of Engineers and Shipbuilders
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

Institute of Marine Engineers, Incorporated
The Minories, Tower Hill, London.

ITALY

Collegio Degli Ingegneri Naval e Meccanici in Italia

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